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The Long-Term Significance Of Working As An Undergraduate Teaching Assistant

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THE LONG-TERM SIGNIFICANCE OF WORKING AS AN UNDERGRADUATE TEACHING ASSISTANT

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Christopher Felege
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My father once told me that he had done everything he could to make a better life for his children than his parents had been able to do for him. He then challenged me to do the same for my family. This work is for my wife and my daughter. I hope it is just a stepping stone. Mom and Dad, I hope I make you proud.

ABSTRACT

The use of undergraduate teaching assistants (UTAs) has increased in recent years at a number of institutions, especially in active-learning and high-enrollment introductory courses. Currently, there is research demonstrating their benefit to students, and the short-term impacts of the experience on the UTAs. However, no study to date has investigated the long-term impacts of the UTA experience on the participants themselves, and a number of studies call for such an investigation. This dissertation sought to fill that gap in understanding by utilizing a Grounded Theory approach to investigate the perceptions of participants who had served as an UTA in the biology department at a large research institution in the upper Midwest. All participants worked as an UTA from two to ten years prior to the interview, and had since graduated and gone on to careers, graduate school, or professional programs. This research found strong consensus among participants that the UTA experience is overwhelmingly positive. Long-term personal benefits included improved self-confidence, a sense of personal reward, and a sense of community that resulted from working with faculty members. Professional benefits that persisted included a strong sense of professional development, beneficial experiences that transferred to life after undergraduate studies, the ability to explore potential careers, and the opportunity to experience more than just research. Additionally, participants reported that financial motivation was not a primary motivation. Furthermore, they provided evidence that concerns from the primary literature about overly burdensome responsibilities and conflicts of interest with other students were not a significant issue during their experiences.

CHAPTER I

INTRODUCTION

In recent years, a trend has emerged in higher education utilizing Undergraduate Teaching Assistants (UTAs) to fill a wide variety of instructional roles (Schalk, McGinnis, Harring, Hendrickson, & Smith, 2009). In some cases, UTAs replace Graduate Teaching Assistants (GTAs) in the role of direct instructional delivery and grading (Drane, Micari, & Light, 2014; Schalk et al., 2009). In other cases, UTAs work in conjunction with GTAs and faculty to augment instructors, especially in active learning environments (Weidert, Wendorf, Gurung, & Filz, 2012). At other times, UTAs fill the role of peer instructors independent of GTAs (Quitadamo, Brahler, & Crouch, 2009). In almost all cases, UTAs typically have fewer responsibilities than traditional GTAs and less perceived authority (Chapin, Wiggins, & Martin-Morris, 2014; Drane et al., 2014; Schalk et al., 2009).

Similarly, there is a wide range of support offered to students in UTA roles. This support ranges from highly structured weekly courses focused on pedagogy and teaching strategies, through highly unstructured programs, to some that offer no support at all (Marbach-Ad et al., 2012). Nearly all programs that utilize UTAs select students based on previous academic performance as part of the selection criteria when hiring from a pool of applicants for such positions (Chapin et al., 2014; Drane et al., 2014; Marbach-Ad et al., 2012).

The majority of published work surrounding UTAs typically examines effects of UTAs on the students with whom they work. To date, most of this work has been quantitative and positivist in nature. Such works typically focus on short-term benefits of the UTAs to the

students they serve, rather than on effects of the experience on the UTAs themselves (Chapin et al., 2014; Drane et al., 2014). Furthermore, such works almost exclusively focus on the effects within a single semester and are limited to examining the positive aspects of such experiences on UTAs and/or the students they serve. No studies have focused on the more holistic long-term effects of such experiences on UTAs. Current investigations that do examine impacts surrounding the use of UTAs generally demonstrate that there is an added benefit to all parties involved, including students served by UTAs, faculty, and the UTAs themselves. However, the positivist nature and short-term focus represents a gap in the understanding relevant to the long-term impacts on UTAs surrounding their experiences. Specifically, there is little or no work exploring qualitatively what the perceived long-term effects are to these UTAs, or how and why these effects arise. The goal of this research study was to fill that knowledge gap by developing an understanding of the long-term impacts of the UTA experience on former participants.

The objective of this chapter is to contextualize this study within the primary literature. A brief description of the limits of the current understanding will be developed to illustrate the current knowledge gap, which this study has addressed. The purpose, significance, and implications of this understanding will then be outlined to illustrate that this work does indeed address a critical need. Finally, operational definitions, study delimitations, and the organization of the study will be described.

Background

There is a long-standing tradition of using Graduate Teaching Assistants (GTA) at many institutions to assist with a variety of teaching duties. Recently, this trend has expanded to increase the use of UTAs (Chapin et al., 2014). A number of works document that TAs, at both the graduate and undergraduate level, benefit the students they serve by increasing metrics of

interest such as retention, attitude, exam performance, and general perceptions about science, specifically within traditional Science Technology Engineering and Math (STEM), fields such as biology, chemistry, engineering, physics, and mathematics (Chapin et al., 2014; Drane et al., 2014; Kendall & Schussler, 2012; Marbach-Ad et al., 2012; Philipp, Tretter, & Rich, 2016b; Quitadamo et al., 2009). Female students and minorities appear to show greater benefit than their white male counterparts (Drane et al., 2014).

Comparatively little research has been done to evaluate what impacts working as a TA has on individuals who participate in this experience, specifically at the undergraduate level. Research that has been conducted focused only on short-term benefits of working as an undergraduate TA. No studies address the impacts on UTAs beyond their transition to graduate school, and such works only concern students who remain within the same academic department. For example, one study demonstrated an increase in professionalism by undergraduates who went on to serve as GTAs in the same department (Weidert et al., 2012). Another study documented that UTAs experience comparable benefits to those students who participate in undergraduate research programs (Schalk et al., 2009). Another work documents financial benefits to TAs (Chapin et al., 2014).

Teaching Assistants

Teaching Assistants (TAs) serve as a positive resource to both students and faculty across a range of disciplines (Weidert et al., 2012). Historically, within the STEM disciplines specifically, TAs have been graduate students whose responsibilities included managing laboratory sections, grading, and a variety of clerical-type work (Chapin et al., 2014; Weidert et al., 2012). From an institutional standpoint, such TAs offered a financially beneficial way to cover lab sections without hiring more expensive faculty. Students in courses served by TAs

have been shown to benefit as a result of increased comfort in approaching TAs compared to faculty with content related questions (Chapin et al., 2014). TAs are perceived as less intimidating than faculty, despite the fact that TAs may not be as competent or experienced about content or course expectations as the faculty member responsible for the course (Kendall & Schussler, 2012). Students served by TAs also generally tend to earn higher grades than those without the support of a TA (Drane et al., 2014).

Teaching Assistants are thought to benefit professionally from their experiences because they gain practice planning course material, managing paperwork, dealing with student management issues, grading, and course development. At the same time, TAs build professional relationships with faculty, increase their curriculum vitae, and are afforded an opportunity to review material and content (Weidert et al., 2012). Experience as a TA, especially in active learning environments, has been reported to increase the ability and confidence of experienced GTAs, which can be important to those who are considering careers in academia and STEM disciplines requiring similar responsibilities (DeBeck & Demaree, 2012). All of these factors have been determined to be beneficial aspects of the TA experience (DeBeck & Demaree, 2012; Weidert et al., 2012).

A range in the support and preparation provided to TAs has been associated with drawbacks as well. For example, TAs often struggle when they find themselves unprepared for their responsibilities, or they find themselves having a conflict of interest with students within their class. This is most likely to occur when they TA for a student in one course, with whom they are enrolled as a peer in another course (Chapin et al., 2014; Weidert et al., 2012). Likewise, TAs are known to struggle with feeling knowledgeable or confident about the content or expectations of a class for which they TA, or being assigned TA responsibilities in a course

that poorly matches their own interests merely to fulfill departmental needs (Chapin et al., 2014; Weidert et al., 2012). Despite these challenges, the benefits of working as a TA are generally considered to outweigh potential drawbacks (Weidert et al., 2012). The notably few references that address these drawbacks have all been limited to short-term timeframes and describe a TA experience that places an emphasis on the positive aspects of such work.

Benefits to faculty as a result of TAs include: increasing contact with students who take courses served by TAs, having a certain level of relief from clerical duties and grading, having additional help to cover course content, and receiving indirect feedback on course progress from the TAs as they interact with students (Weidert et al., 2012). Drawbacks of TAs to faculty can include potential time to teach and support them (if they are unprepared or lack confidence), and the responsibilities associated with mentoring, supervising, and correcting mistakes if they occur (Weidert et al., 2012). Nonetheless, benefits of having TAs is generally considered to outweigh the drawbacks (Weidert et al., 2012).

Undergraduate Teaching Assistants

Departments often find that the pool of available GTAs is not sufficient to meet their needs because graduate students balance other responsibilities such as research and classes in which they themselves are enrolled. Financial constraints have also led programs in recent years to explore alternatives to GTAs. Several programs have begun utilizing UTAs to augment their overall pool of TAs when there are not enough graduate students to fulfill departmental TA needs (Chapin et al., 2014). Students who work as UTAs are almost always selected based in part on previous academic performance, and oftentimes based on their own expressed interest in the course and its content, as well as their personality and experience with the faculty instructing the course (Chapin et al., 2014; Drane et al., 2014; Marbach-Ad et al., 2012). In the first large-

scale work directly addressing the effect of equally supported UTAs compared to GTAs on student learning, Chapin et al. (2014) found that undergraduate science learners showed comparable learning outcomes regardless of TA type. Student grades showed no significant difference between labs run by UTAs compared to GTAs. Student attitude toward science was equally positive between students taught by either group, and UTAs actually had a statistically higher impact than GTAs on their ability to encourage and respect the students they worked with when those students were surveyed about the attributes of their TAs without being informed of whether the TA was an undergraduate or a graduate (Chapin et al., 2014). Undergraduate TAs are oftentimes even more financially beneficial to departments and programs than GTAs, especially within STEM disciplines, because UTAs are provided a small hourly wage, while GTAs are generally provided a tuition waiver and a stipend that represents a larger financial commitment than the hourly wage of an UTA (Chapin et al., 2014).

Similar to GTAs, UTAs report short-term benefits from the experience associated with their duties that include exploring potential career options as eventual faculty members. Undergraduate TAs additionally report short-term benefits such as exploring the responsibilities of graduate school, the opportunity to review content and material, financial or monetary reasons for working as a TA, and the opportunity to increase their curriculum vitae (Chapin et al., 2014; Weidert et al., 2012; Wheeler, Maeng, & Whitworth, 2015).

Support for Teaching Assistants

Support for teaching assistants varies greatly, ranging from some programs offering highly-structured weekly training and support programs focused on content delivery and pedagogy, to others offering no support at all (Marbach-Ad et al., 2012). There are reports within the primary literature documenting an increase in critical thinking by students when

working with trained and supported TAs (Quitadamo et al., 2009; Snyder & Wiles, 2015). Other work demonstrates a variety of benefits that include increases in student grades, more positive perceptions about science, and more positive student attitudes when working with UTAs who have the benefit of a training and support program (Chapin et al., 2014). Still others demonstrate increases in students' time-on-task, exam achievement, and general affective characteristics when supported by UTAs who have undergone or participated in some form of formal support (Chan & Bauer, 2015). Other reports claim that working as an UTA makes students more prepared for careers in Science and Math (DeBeck, Settelmeyer, Li, & Demaree, 2010; Drane et al., 2014; Otero, Pollock, & Finkelstein, 2010; Spike & Finkelstein, 2010; Spike, Finkelstein, Rebello, Engelhardt, & Singh, 2012). However, no work to date has examined these claims regarding any long-term effects of working in such a capacity to the UTAs themselves with the support of empirical evidence or first-hand accounts.

Statement of the Problem

There is ample documentation in the primary literature to demonstrate that UTAs are consistently selected based on their academic performance and perceived potential by the faculty with whom they work (Chapin et al., 2014; Drane et al., 2014; Marbach-Ad et al., 2012). Likewise, there is documentation within the primary literature that students selected to work as UTAs display a variety of personal characteristics which can be fostered to increase their professional potential such as self-confidence, communication abilities, and a variety of leadership skills (Chapin et al., 2014; Schalk et al., 2009). Based on such documentation, it would seem reasonable to hypothesize that UTAs represent a group of students who should go on to have a high proportion of successful careers because of their potential. Indeed, there are also a number of reports that hypothesize that working as an UTA should foster a set of

knowledge and skills that would make students more likely to succeed in STEM-related careers (DeBeck & Demaree, 2012; DeBeck et al., 2010; Drane et al., 2014; Otero et al., 2010; Spike & Finkelstein, 2010; Spike et al., 2012). Nonetheless, there is little in the primary literature investigating such an assumption. Nor is there an investigation that reports any impacts on the long-term personal, professional, or financial impacts of having worked as an UTA. The primary literature is limited to documenting only short-term benefits focused on positive aspects in these areas (Chapin et al., 2014; Drane et al., 2014; Kendall & Schussler, 2012; Marbach-Ad et al., 2012; Schalk et al., 2009; Spike & Finkelstein, 2010; Weidert et al., 2012; Wheeler et al., 2015). This research study is the first to address that knowledge gap by documenting the perceived long-term effects on UTAs following their experience, graduation, and transition to professional programs, graduate school, and careers.

Significance of the Study

Persistent financial challenges coupled with mounting pressure to provide increased high impact practices that promote student success will likely lead to the increased use of UTAs at a wide range of institutions (Chapin et al., 2014). Therefore, research that demonstrates if the UTA experiences are indeed highly-impactful related to the long-term success of not only the students taking the courses, but also those serving as UTAs would be valuable for institutional incorporation of this practice. Furthermore, reflective perspectives of UTAs about their experiences can provide guidance for programs to support UTAs to optimize the benefits of the experience for all parties (i.e., students taking class, UTA, and faculty) involved (Schalk et al., 2009; Weidert et al., 2012).

Purpose of the Study

The purpose of this research was to examine perceptions about the long-term effects of working as an UTA by former students who worked in this role. Because no comparable work was located and because this investigation sought to establish an understanding about if, how, and why the UTA experience may affect participants over a long-term time period, a Grounded Theory approach was utilized to develop an understanding about participant perceptions (Glaser & Strauss, 1967).

Despite its name, Grounded Theory is actually a methodological approach generally practiced in qualitative research that seeks to generate theory from within the data itself (Glaser & Strauss, 1967; Straus & Corbin, 1990). While the goal of this approach is generating theory, few works actually succeed in such endeavors because true theory generation is difficult (Strauss & Corbin, 1998). The difficulty of theory generation does not diminish the value of what can be learned from a Grounded Theory approach however, especially when little is known about a topic or subject, and an investigator is attempting to develop an understanding about emergent concepts (Glaser & Strauss, 2009). In such cases like that here, a Grounded Theory approach is appropriate because it promotes the identification of core variables, challenges an investigator's preconceptions through an exploration of emergent concepts, and facilitates the discovery of stable patterns rooted within the data itself (Glaser & Strauss, 2009).

No previous studies explore what the perceived long-term effects of working as an UTA may be by those who have experience in that role. Nor is there research investigating how or why these perceptions arise. As a result, this research can provide novel and valuable understanding to the primary literature. It closes the gap in current understanding in a manner

that can hopefully be used maximize the benefit to students who work as UTAs in the future and provides documentation of the perceived long term-term effect of the UTA experience.

Research Question

The overarching research question that guided this qualitative investigation was: "What are the perceived long-term effects of working as an Undergraduate Teaching Assistant?" Semi-structured interviews and subsequent analysis were conducted with 13 voluntary participants to qualitatively explore factors associated with their UTA experiences. Grounded Theory advocates the discovery of theory rooted in the data itself (Glaser & Strauss, 1967; Wilson, Z. S., Holmes, L., Sylvain, M. R., Batiste, L., Johnson, M., McGuire, S. Y., Warner, 2012). Because no similar work was identified as a guide for comparison at the onset of this research, it was tentatively proposed that themes related to UTA's personal, professional, and financial experiences would arise as a result of their experiences, and that most of these experiences were likely to be perceived as beneficial.

Operational Definitions

Active Learning Environment: Any instructional setting that seeks to formally transition away from traditional, passive teaching styles such as lecture in favor of more engaging pedagogical approaches.

GRE: Graduate Registry Exam, encouraged or required exam by most graduate programs in the STEM fields. This exam is analogous to the SAT but usually is completed toward the end or after completion of an undergraduate degree.

Grounded Theory: Grounded Theory is a methodological approach utilized to systematically compare and contrast data for repeating patterns rooted or grounded from within participant experiences. In this dissertation it refers specifically to Constructivist Grounded

Theory, following the guidelines of Kathy Charmaz, which evolved from the original Classic Grounded Theory of Glaser and Strauss. Constructivist Grounded Theory is used to sample, code, compare, and refine an investigator's understanding about a phenomenon until a point of data saturation is reached, and to continually refine that understanding by systematically re-examining and refining an evolving understanding through careful documentation of that ongoing compare-and-contrast process.

GTA: A Graduate Teaching Assistant is a student pursuing a master's degree or a Ph.D. who already has at least a Bachelor's degree, and who fills an instructional role as part of their assigned duties to the department. These can be in a laboratory, lecture, or active learning environment.

IRB: Institutional Review Board is the body responsible for oversight and approval of studies.

LA: Learning Assistants are fundamentally similar, and functionally identical to undergraduate teaching assistants and peer leaders. It is a term used to refer to students following a model for utilizing undergraduate peer instructors that originated out of the University of Colorado.

Lab: A hands-on environment commonly associated with STEM discipline fields such as biology, chemistry, and physics, where students learn technical skills and procedural knowledge associated with a given field to increase competency and skills.

Long-term: For this study, long-term will indicate a time span of greater than one year. Most primary literature related to the topic of UTAs is limited to the impacts of the experience over a single semester and are quantitative in nature. This study explored broader, larger impacts over a longer time horizon, ideally through an individual's transition to graduate school,

professional school, and/or careers in order to explore perceived impacts of the UTA surrounding these experiences.

MCAT: Medical school entry exam that is required by most medical schools.

Peer Leader: Peer leader is a term often found in the primary literature that refers to an undergraduate who has experience in a class or lab mentoring a group of less-experienced peers through that class and the associated content. They are functionally similar to undergraduate teaching assistants, though some models utilize them in class, and others have them working outside of class.

PLTL: Peer Led Team Learning is another strategy for utilizing undergraduates to assist in instructing other undergraduates that is common in the primary literature. Again, PLTL's are fundamentally similar, and functionally identical to UTAs.

SCALE-UP: Student Centered Active Learning Environment for Undergraduate Programs – a room specifically designed with active learning pedagogy in mind. Round tables and problem-based learning are meant to increase student engagement and promote higher-order thinking. Such environments frequently employ UTAs and/or graduate teaching assistants (GTAs), to help facilitate learning. These rooms trace back to Dr. Robert Beichner at the University of North Carolina.

Short-term: For this study, short-term will be used to describe any impact experienced over a course of time that is less than one year. Most primary literature related to the topic of UTAs is limited to the impacts of the experience over a single semester and are quantitative in nature. This proposed study seeks to explore broader, larger impacts over a longer time horizon.

STEM: An abbreviation commonly utilized to designate the fields of Science, Technology, Engineering, and Math.

TA: Teaching Assistant is any student, graduate or undergraduate, who works in a role that supports student learning in either a lab, lecture, or active learning environment.

UTA: An Undergraduate Teaching Assistant is a student who has not yet earned a Bachelor's degree, but is being utilized in an instructional capacity within the department. This can be within a laboratory, lecture, or active learning environment. NOTE: The primary literature can be confusing about this term, because there are some programs that call students in this role "LAs" – short for "Learning Assistants". Others refer to them as "PL's" for "Peer Leaders". Functionally, they are the same as "UTAs" in this study because they are undergraduate students working in an instructional capacity.

Study Delimitations

Interview participants were limited to individuals who worked as UTAs within the Biology Department at an upper Midwestern research university. That department provided a list of contacts that dated back 10 years. This pool of potential participants was contacted upon approval of the IRB and asked if they would be willing to voluntarily participate in a semi-structured interview related to their experiences working as an UTA. The sample of interview participants included 14 individuals, only 13 of whom were included in the analysis, because one individual informed the investigator that they had actually been a GTA: their information had been mis-recorded by the department. Despite a relatively small number of participants for a Grounded Theory approach, data saturation was reached with no new codes, categories, or relationships arising when 11 participant interviews had been completed. Demographic variables were explored including age and date since the UTA experience was concluded, number of times an individual worked as an UTA, gender, academic level at the time of the experience, socioeconomic status (SES), and faculty with whom the experience was completed. The

constant comparison of a Grounded Theory approach enabled the investigator to explore similarities and differences within and among participants with different backgrounds. This approach was insightful in developing an understanding of the long-term impacts of working as an UTA, and understanding the implications of these effects to better improve the experience for students moving forward.

Organization of the Study

Following this introductory chapter, a detailed literature review on the topic of working as a TA, with a specific focus on undergraduates, is found in Chapter II. In that chapter the stage will be set for the current study by establishing the bounds of what is currently understood about UTAs related to the impacts and experiences of working in that role. Freedom for the open exploration of data and subsequent interpretation in alignment with Grounded Theory is provided (Roulston, 2010).

Chapter III details the Grounded Theory approach utilized by this research study. The exploratory nature of qualitative interviews requires an open mind for emergent themes and codes to be developed and explored through a constant compare-and-contrast approach. This compare-and-contrast approach enables a researcher to identify phenomenon, events, or settings-of-interest, along with concepts, principles, and processes that are likely to be insightful or meaningful in understanding some aspect of the social world and how it works (Glaser & Strauss, 1967).

Chapter IV includes a presentation of the data with respect to the preliminary literature review from Chapter II, as well as subsequent literature which was added after data collection and analysis began. Findings from the qualitative interviews will be discussed in relation to both sets of primary literature. The relevance of this literature to the emergence of codes, categories,

and themes will be discussed. Contextualized by the methodological approach of Chapter III, an understanding of the perceived long-term effects of working as an UTA are then presented (Wilson et al., 2012).

Chapter V contains a summary and conclusions section that discusses interpretations of the major findings from this research. Recommendations for practice are also included. All work is rooted in examples from the data, identified and developed through the constant compare-and contrast approaches that exemplify Grounded Theory (Charmaz, 2006; Strauss & Corbin, 1998; Wilson et al., 2012). Finally, Chapter V concludes with a reflection by the investigator.

CHAPTER II

REVIEW OF THE LITERATURE

Review of the primary literature reveals a critical gap in knowledge regarding the long-term effects on students who have served as undergraduate teaching assistant (UTAs). This review addresses three issues regarding that gap. First, no works could be found which investigated these effects. Second, this absence of relevant material required usage of other literature to establish a starting point for this study. Literature chosen related to the impacts teaching assistants (TAs) had on the students they serve. This was done to explore if TAs may perceive benefits similar to those of the students they serve, and if so, what those perceived benefits might be. Finally, works investigating short-term effects on TAs at both the graduate and undergraduate level were utilized to explore whether short-term benefits persist over a longer time frame. This examination of the literature provided a conceptual basis for the current study while at the same time allowing for the open-ended exploration of data critical to successful qualitative research. These three sections are used to build the fourth section of this chapter, which proposes reasons why individuals might be interested in participating in the UTA experience. This chapter is augmented by further discussion in Chapter IV, relating findings from this study to a broader range of relevant literature.

Short-Term Effects of Teaching Assistants on Others

Teaching assistants at both the graduate and undergraduate level have a variety of positive impacts on the students with whom they work. However, the efficacy of active learning environments such as labs and Student Centered Active Learning Environments for

Undergraduate Programs (SCALE-UP), are limited by the skill of the instructor in such environments (DeBeck & Demaree, 2012; Drane et al., 2014). Teaching assistants are frequently utilized in such environments where they are often the primary contact for students, acting as middlemen between a faculty member and the students. It should come as no surprise that a number of works demonstrate that professional development or training of GTAs and UTAs has been shown to improve TA efficacy at facilitating student performance and learning in a variety of environments. This finding applies specifically to labs and active learning environments (DeBeck & Demaree, 2012; Kendall & Schussler, 2012; Philipp et al., 2016b; Snyder & Wiles, 2015). These works provide a strong conceptual framework outlining the impacts on students, and in some cases TAs, but are not without their limitations.

Literature related to GTAs or mixed pools of GTAs and UTAs can be an acceptable substitute of information where there are not studies related to UTAs specifically (Schalk et al., 2009). Additionally, this review draws on literature that refers to peer leaders in place of UTAs, following the precedent of Philipp et al. (2016b). Peer leaders are analogous to UTAs because, along with UTAs and GTAs, they are not expected to be content experts or surrogate instructors (Philipp et al., 2016b). Instead, they are students who have successfully completed the same or similar course. They have been identified by the faculty member in charge of the course, or the department, to have potential at improving student learning and performance through increased small group dynamics. They accomplish this task by acting as a supplementary resource to the students they serve (Philipp, Tretter, & Rich, 2016a; Philipp et al., 2016b; Quitadamo et al., 2009; Schalk et al., 2009).

Approachability by Peers

One manner TAs impact student learning is by serving as a primary source of content for students and acting as an intermediate between students and faculty members (DeBeck & Demaree, 2012). In one of the largest studies that collected data for 10 years across five Science Technology Engineering and Math (STEM), disciplines at a single institution, Drane et al. (2014) identified that one of the greatest impacts UTAs (referred to as peer-leaders in their work, but functionally comparable to UTAs), was that they were perceived as being more approachable (Drane et al., 2014; Philipp et al., 2016b). Drane et al. (2014) demonstrated that the use of peers to facilitate small-group (generally 5-7 students), peer-led learning models allowed students to collaboratively work through challenging STEM-related problems, yet found differences in the level of student-outcome between different disciplines such as biology, chemistry, physics, and math (Drane et al., 2014). Similarly, GTAs have also been shown to be more approachable than faculty because, despite having less content knowledge than a faculty member, their method of teaching is often less formal. This informality leads students to perceive them as more identifiable, enthusiastic and relatable as role models than faculty members, because GTAs are perceived as more flexible, understanding, and approachable (Kendall & Schussler, 2012).

A study by Snyder and Wiles (2015) demonstrated that peer-leaders serving in a role functionally analogous to UTAs created significantly more interactions between students and peer leaders than in a traditional instructor-centered environment. These increased interactions were largely due to the approachability of these peer leaders, which subsequently decreased intimidation by students who sought support in an active-learning environment. Ultimately, this increased interaction improved critical thinking skills in students from all demographics and backgrounds (Snyder & Wiles, 2015). Important to this study, Snyder and Wiles (2015)

suggested that the peer-leaders improved their own critical thinking skills, problem solving abilities, communication, content knowledge, and self-confidence, but explicitly state that no previous work had examined these claims. They acknowledged that their work did not formally address these observations either because of its focus on students and identified this topic as a direction for future investigation. Specifically, they acknowledge that no works existed demonstrating the long-term effects of such an experience on UTAs in a leadership role, further demonstrating a documented critical need that this work addresses (Snyder & Wiles, 2015).

Communication Skills Increase Among Students

Similarly, Drane et al. (2014) suggested that communication between peer leaders and members of small-groups they worked with resulted in an improvement in student learning (Drane et al., 2014). They attributed increased communication with and by students to peer-leadership and felt that this communication largely contributed to the improvements between the various disciplines included in their 10-year study. They also suggested that these improvements should be an area for future research (Drane et al., 2014). Snyder and Wiles (2015) likewise reported an increase in the frequency and length of communication by students in active learning environments with peer leaders facilitating the environment. Again, they outwardly state that no works exist documenting the long-term impacts of such phenomena on the peer-facilitators themselves (Snyder & Wiles, 2015). The short-term impacts of both UTAs and GTAs on communication with students was also addressed by Weidert et al. (2012), who compared the communication of UTAs with GTAs. Using a pool of mixed UTAs and GTAs, their work described that UTAs were reported to be better communicators with students than GTAs, although reported scores on a Likert-scale were comparable. This finding mirrored the report of

a later work by Chapin et al. (2014), who describe UTAs as slightly more effective than GTAs (Chapin et al., 2014; Weidert et al., 2012).

Decreased Intimidation by Students

A number of studies have examined perceptions related to intimidation by students. In general, these works categorize intimidation related to content, and intimidation related to approaching faculty for help, assistance, and support. Students typically perceive TAs as far less intimidating than faculty, and report being much more likely to seek help or support from GTAs than faculty members when struggling with content. This is despite the fact that GTAs are perceived as less knowledgeable than faculty and are perceived as having less control over a course and its content or pace. Nearly all research in this area agrees that this decreased intimidation related to GTAs translates to increased student engagement because students are more likely to reach out for help if they are less intimidated. Decreased intimidation has a number of benefits directly related to student learning (Kendall & Schussler, 2012). A general summary of the large body of work surrounding this topic is that GTAs are perceived by students as more adaptable, approachable, flexible, and informal. This makes students more likely to reach out to them instead of faculty for help when students identify that they are struggling and need support or assistance. While there is less work examining the perceptions of students about UTAs, at least one study reported that UTAs are perceived by students to be at least as good as GTAs (Chapin et al. 2014).

Increased Grades by Students

Grades are a common metric across most studies that deal with any question related to student performance. Several works have examined the impact of UTAs on student grades as a measure of performance. For example, Chapin et al. (2014) compared the common practice of

GTAs running labs with a newly-developed UTA program at their institution. Their work demonstrated that students taught by UTAs performed just as well as those taught by GTAs when both UTAs and GTAs received equal preparation, training, and support (Chapin et al., 2014). Drane et al. (2014) demonstrated that peer-leaders had a positive impact not only on grades, but on retention and persistence as well. Students who worked with peer-leaders were more likely to earn higher grades in five of the seven courses they examined over a 10-year study period, to successfully complete the course served by peer leaders, and to subsequently go on and complete courses that were part of a required sequence within their major (Drane et al., 2014). Snyder and Wiles (2015) further support the positive impacts of peer-leaders working in roles analogous to UTAs across a variety of demographics, academic majors, and personal backgrounds on the grades of their students (Snyder & Wiles, 2015). Important to this study, they note several times in their work the lack of parallel research on the impacts of UTAs or peer-leaders to the documented benefits on the students they serve (Snyder & Wiles, 2015).

Other works that utilized grades as a metric of TA impact on students consistently found that UTAs had a positive impact on the final grade and final exam performance of students in introductory chemistry (Philipp et al., 2016b). Philipp et al. (2016b) focused specifically on UTAs, but only followed their effects on students focused over a single semester. They note that students in their study were more likely to persist into sequential courses than those without UTAs (Philipp et al., 2016b). Other more expansive work confirmed the trend of increased grades in students served by peer-leaders working in roles analogous to UTAs. Across science and math courses, this trend was believed to be the result of increased critical thinking in students served in such settings (Quitadamo et al., 2009).

Improved Attitude by Students Toward Content Matter and Science in General

A positive attitude is generally agreed to be important to success in many fields. A number of works have examined and consistently found positive impacts of UTAs on the attitudes of the students with whom they work. For example, Chapin et al. (2014) demonstrated that not only were UTAs beneficial at improving student attitude toward both course content and science in general, but they were better than GTAs who had traditionally filled such roles. They attributed this to UTAs being perceived as more approachable and relatable than GTAs (Chapin et al., 2014). Drane et al. (2014) report similar conclusions across their 10 years of data collection, asserting that students in the role of UTA improve the attitude of students and decrease their intimidation with content specific to a course, and science in general (Drane et al., 2014).

Mentorship by Other TAs and Faculty

Mentoring by undergraduate peers is any example of a more confident or experienced peer guiding another less experienced peer. Previous research demonstrated that students working as an UTA or peer-leader effectively mentor the intellectual development of those less-experienced peers (Chan & Bauer, 2015; Drane et al., 2014). Those UTAs who participate in training programs designed to facilitate their pedagogical development are even more effective than UTAs without such training. However, either trained or untrained UTAs can play a pivotal role in the education of other undergraduates because of the increase in access to mentoring they provide their junior peers (Sana, Pachai, & Kim, 2011). Despite being peers to the students they serve, peer-leaders working in roles analogous to UTAs are viewed as mentor figures by the less-experienced students. They provide these students with a sympathetic guiding presence that is lacking in traditional entry-level STEM courses in lecture settings led by a faculty member

(Drane et al., 2014). This mentorship is essential to the development of critical thinking skills in students served by peer leaders (Snyder & Wiles, 2015).

Professional Development by Students

Professional development is discussed in a wide range of work related to TAs and peer leaders. It is generally in the context of any situation that helps individuals improve their knowledge, competence, skill, or effectiveness (Drane et al., 2014; Marbach-Ad et al., 2012; Weidert et al., 2012). Undergraduate and GTAs alike have been shown to develop student professionalism in a wide variety of work, but the term professional development can take on many meanings. For example, Chan and Bauer (2015) showed that undergraduate peer leaders improved the professional development of their chemistry students because they provided greater student access than faculty members. This access resulted in more contact time than a faculty member alone could provide (Chan & Bauer, 2015). Professional development in their work generally referred to the quality of work produced by those students. Snyder and Wiles (2015) on the other hand claim that the increases in critical thinking which they documented in students as the result of peer leaders were likely to contribute positively to a student's future profession and their general contribution to society. While this may intuitively makes sense, both the profession and the contribution are never defined, leaving a reader to infer what these benefits or contributions might be (Snyder & Wiles, 2015). Similarly, Weidert et al. (2015) suggest that professional development is one of the practical implications for students served by both UTAs and GTAs, but also fail to concretely define or describe what that development specifically is. Instead, they discuss it by characterizing attributes like communication and dialogue, attendance, and quality of student work such as essays and reflective papers (Weidert et al., 2012).

Workload Reduction by Faculty

One of the aspects that is reported to make GTAs more relatable to undergraduates is the fact that GTAs are perceived by undergraduates as still being students themselves. While this perception does have some negative implications related to the level of expertise, it has benefits that outweigh these perceptions. For example, GTAs are perceived by students as being more familiar with academic demands such as balancing multiple courses and other responsibilities. As a result, they are perceived as more likely to be understanding, approachable, and relatable. This means that students will often seek help or support from them before going to a faculty member, thus reducing the demand on the faculty and decreasing intimidation by students (Kendall & Schussler, 2012).

Not all works agree that the use of TAs decreases the workload on faculty. Weidert et al. (2012) reported contradictory views by showing that faculty perceived an increase in workload as the result of utilizing UTAs and GTAs. This extra time was the result of a need to train, mentor, and supervise these TAs. Additionally, further faculty time was reported as being needed to correct mistakes, address confusion, and encourage students to utilize the TAs (Weidert et al., 2012).

Critical Thinking and Metacognitive Skills

Critical thinking and improved metacognitive skills are among the other benefits of TAs and peer leaders in similar roles working with students. Drane et al. (2014) discuss that the increased grades they reported in students based on peer leadership is actually the result of promoting students' sense of belonging, problem-solving skills, critical thinking, and metacognitive strategies. They argue that these increases are far more important

developmentally than student grades because these skills are what will enable students to learn throughout their lives (Drane et al., 2014).

Snyder and Wiles (2015) support this argument. They first documented an increase in critical thinking and metacognitive skills by students in introductory biology. These students were from a variety of academic majors and a range of personal backgrounds. These researchers used a quasi-experimental design that took advantage of pre-validated metric in the form of a pre-and post-exam. Complete with control groups, their work showed significant gains in the critical thinking and metacognitive skills of students who worked with peer leaders analogous to UTAs, compared to similar students without the help or support of peer-leaders (Snyder & Wiles, 2015).

Philipp et al. (2016b) support these findings with their work specific to UTAs in a single semester chemistry course. Framed by Lave and Wenger's Community of Practice Theory, coupled with Martin and Suls' Proxy Model of Social Comparison, they showed that UTAs increase the critical thinking and metacognitive skills of their students compared to a no-treatment group. This increase was attributed to UTAs implementing pedagogical practices such as questioning approaches, mental modeling, and unpacking strategies that were covered in a three-day pre-semester training program and supported with bi-monthly seminars and weekly planning meetings for the UTAs. The number of students who enrolled in the next sequential chemistry class compared to the no-treatment group also increased in their study (Philipp et al., 2016b).

The work of Drane et al. (2014), Snyder and Wiles (2015), and Philipp et al. (2016a) support earlier work demonstrating increased critical thinking by students who worked with peer-leaders serving in a role analogous to UTAs (Quitadamo et al., 2009). Specifically,

Quitadamo et al. (2009) was the first work addressing a common critique in the primary literature. Prior to their work, there had been no direct comparison of students who were served by peer-leaders directly against non-peer-leader-led students in comparable settings. In their work, Quitadamo et al. (2009) demonstrated that peer-leaders do in fact increase the critical thinking of students they serve compared to non-peer-led students, and like Drane et al. (2014), argue that critical thinking is a far more effective metric of evidence of learning than grades or standardized test performance (Quitadamo et al., 2009).

Persistence in Science Fields

Philip et al. (2016b) was one of the few works specific to UTAs. They examined two groups of students, trained UTAs, and a control group of unsupported comparable students (i.e., no UTAs). These two groups from a single-semester chemistry course were compared. Their research question focused on student performance as measured by course and final exam grades, along with critical thinking and metacognitive ability. All measured categories improved in the UTA-supported students compared to the control group who were taught without the support of UTAs. While not a direct focus of their original question, they did document that statistically more students in the UTA-supported group enrolled in the subsequent chemistry course that was next in the sequence of courses for science and engineering majors. Based on the increased subsequent enrollment, they concluded that the use of UTAs also improved the persistence of the students they served (Philipp et al., 2016b). The students felt more encouraged to persist because the UTAs themselves had recently experienced the same chemistry course. The peer-to-peer relationship made UTAs effective at encouraging other students to continue by effectively creating a community of practice. This community fostered a sense of mentorship between the

UTAs and the entry-level students that directly resulted in increased student persistence (Lave & Wenger, 1998; Philipp et al., 2016b).

Self-perception, Efficacy, and Confidence

Undergraduate TAs also have been shown to have a variety of effects on how the students they work with see themselves. However, self-perception, perceived self-efficacy, and self-confidence may be the most highly impactful outcomes that UTAs have. These three characteristics consistently relate to student persistence throughout the primary literature. Self-concept refers to an individual's persistent perceptions and beliefs about themselves (Bauer, 2005). This is slightly different but very similar to self-efficacy, which incorporates both a judgement about an individual's ability, and their confidence in that ability to accomplish specific tasks (Pintrich & De Groot, 1990). Undergraduate TAs and peer leaders have been shown to increase self-concept and self-efficacy in the students with which they work, especially in high-enrollment introductory classes like those in the current study (Chan & Bauer, 2015; Drane et al., 2014; Snyder & Wiles, 2015; Weidert et al., 2012). Additionally, UTAs have been shown to make students feel more comfortable and confident with material within a single course, which increases students' reported plans to persist in STEM fields (Chapin et al., 2014).

Short-Term Effects of Serving as a Teaching Assistant

Teaching assistants at both the graduate and undergraduate level, along with peer leaders in analogous roles to UTAs, are reported to experience a variety of impacts themselves. Unfortunately, empirical evidence is limited to short-term work. A number of studies utilized in this literature review state that the long-term impacts of such an experience represent a critical need in the primary literature. Specifically, Snyder and Wiles (2015) address this in the context of peer leaders who have worked in high enrollment introductory biology courses (Snyder &

Wiles, 2015). A number of works build a case that benefits are likely to arise for TAs as a result of their work.

Communication Skills are Reported to Increase

Several works present findings that show TAs improve their communication skills because of their experiences. For example, Kendal and Schussler (2012) demonstrated that GTAs improve their communication skills as a result of the frequent feedback provided by student interaction in non-traditional teaching settings that included laboratories and discussion-based environments outside of traditional lecture (Kendall & Schussler, 2012). In that study, the authors monitored the perceptions of undergraduates, fellow GTAs, and faculty members through open-ended responses as they worked with the GTAs during the semester. Their approach allowed for the simultaneous comparison of undergraduate opinions compared to self-reflections of GTAs and evaluations of faculty members; all confirmed this improvement in communication ability (Kendall & Schussler, 2012).

Philipp et al. (2016a) reported that trained and supported UTAs improved their communication skills in entry-level STEM courses across nine different departments. Their study was conducted at a large research-intensive university where an UTA training and support program had recently been implemented. The goal of that program was to facilitate the use of UTAs in high-enrollment entry level STEM courses (Philipp et al., 2016a). In a similar work published the same year, the same authors showed that both UTAs and GTAs improved their communication skills as the result of leading recitation sections in an entry-level general chemistry course (Philipp et al., 2016b).

Finally, Snyder and Wiles (2015) similarly found that peer leaders working in roles analogous to UTAs improved their communication skills while at the same time increasing their

interest in teaching (Snyder & Wiles, 2015). In this case, peer leaders were responsible for facilitating group work during active-learning activities in high enrollment entry level biology courses. Triangulated through surveys, focus groups, and interviews, their work showed that peer leaders consistently improved their communication skills and their cognitive skills (Snyder & Wiles, 2015). Significant to this study, Snyder and Wiles (2015) state directly that no long-term information exists to confirm if these benefits persist, and as a result, cannot be confidently claimed as a result of their work. This claim is an identified critical need which the current study addresses.

Chapin et al. (2014) reported that serving as an UTA improved the attitude of not only the students but also the TAs themselves toward the content and subject for which they were responsible (Chapin et al., 2014). In their study, all UTAs had recently taken the class for which they were serving, and all had been selected because of their strong understanding of the selected material. Graduate TAs in their work were expected to already have a strong understanding because of their advanced progression in academia. Both UTAs and GTAs benefited in approximately equal ways from the coupling of preliminary and concurrent support related to content and pedagogy. In other words, students served by either UTAs or GTAs improved equally. Additionally, UTAs and GTAs both reported improving their own comfort with content. Chapin et al. (2014) were specific in pointing out that their data should not be interpreted to mean the UTAs can completely replace GTAs as a cost-saving measure. Instead, they proposed that their work showed that careful selection of strong potential candidates from both pools of undergraduate and graduate TAs could effectively augment or supplement student support while simultaneously benefiting TAs from both levels who served in those roles (Chapin et al., 2014).

Snyder and Wiles (2015) reported similar findings. Their work demonstrated that peer leaders working in a role analogous to UTAs benefit not only in content knowledge, but in conceptual reasoning and critical thinking as well (Snyder & Wiles, 2015). Furthermore, they anecdotally concluded that peer leaders develop beneficial relationships with their faculty mentors. Additionally, the peer leaders themselves consistently reported an increase in their own perceived critical thinking abilities, content knowledge, and confidence as a result of their experiences (Snyder & Wiles, 2015). Previously validated metrics confirm increased content knowledge and confidence in these peer leaders, but presented mixed results related to critical thinking. In summary, peer leaders often reported improved critical thinking skills as a result of their experience, with 63% reporting improved critical thinking, but only 43% actually improving their critical thinking as measured with a pre-validated metric assessing critical thinking (Snyder & Wiles, 2015).

Similarly, Philipp et al. (2016a) and Weidert et al. (2012), who worked with a mixed pool of GTAs and UTAs, both reported perceived increases in critical thinking and metacognitive skills by their participants. However, unlike Snyder and Wiles (2015), their works utilized only self-reported perceptions that were not supported with pre-validated metrics specifically and intentionally meant to measure these variables (Snyder & Wiles, 2015).

Schalk et al. (2009), however, had empirically confirmed the acquisition of both content knowledge and laboratory skills in UTAs previously. By utilizing a validated rubric originally designed to evaluate GTAs, coupled with a novel Likert scale survey, they showed that UTAs developed professional characteristics such as self-confidence, communication skills, and leadership abilities. Additionally, these same UTAs increased their content knowledge while refining and expanding their repertoire of laboratory skills (Schalk et al., 2009).

Professionalism is Reported to Increase

The professionalism of TAs and peer leaders has also been widely reported to increase as a result of their experiences. As previously related to impacts on students, the definition for professionalism related to UTAs is also often either vague, general, or left open to interpretation by the reader (DeBeck et al., 2010; Marbach-Ad et al., 2012). Despite the lack of a precise definition, many of the works utilized here support the claim that experience as a TA or peer leader improves the professionalism of participants because of the opportunity it provides to work with students.

For example, DeBeck et al. (2010) reported that GTAs did not perceive any increases in their own professional development as the result of a pre-semester training and orientation course. These pre-semester sessions were reported as useless by GTAs because of how vague such programs were perceived as being (DeBeck et al., 2010). There are mixed opinions about the effectiveness of a TA seminar in their work. Instead, actual classroom experience where GTAs interacted with students and participated in activities focused on effective use of a SCALE-UP space were reported by GTAs as providing the most effective professional development (DeBeck et al., 2010).

Kendall and Schussler (2012) suggest that the positive facets of working as a TA maximizes professional development, specifically including the relatability, engaging, and approachable attributes of TAs compared to faculty members. Areas they identify for improving professional development include making TAs more comfortable in their roles by decreasing their nervousness, uncertainty, and hesitancy. Encouraging pedagogical development is proposed as a mechanism to accomplish all of this and make TAs feel more confident and knowledgeable (Kendall & Schussler, 2012). This largely agrees with the work of Snyder and

Wiles (2015), who concluded that peer leaders developed both professionally and personally as a result of their interactions with students, which helped them feel more confident and comfortable in the role of peer leaders (Snyder & Wiles, 2015).

Philipp et al. (2016a) confirmed that TAs find their experiences to be important relative to their own perceived professional development (Philipp et al., 2016a). Participants in their research attributed such development to the mentorship they received from faculty. Faculty in the field of science education were specifically identified as providing valuable insight because of the research-based, student-centered instructional strategies which they integrated into the training and support (Philipp et al., 2016a). These integrated strategies and their reported benefit are in direct alignment with the earlier work of DeBeck et al. (2010) and confirmed the claims of Weidert et al. (2012), who assert that TAs at both the graduate and undergraduate level can and do develop professionally from their experiences.

Chapin et al. (2014) also discussed professional development directly, yet in the context of teaching. They make the assertion that improved pedagogical skills equated to professional development in TAs at both the graduate and undergraduate level. While they discuss many of the same characteristics of other studies, their work adds leadership skills to the list of attributes identified as being characteristic of professional development (Chapin et al., 2014). Schalk et al. (2009), also address leadership as a characteristic that is developed by individuals working in the role of a TA (Schalk et al., 2009).

Self-confidence, Self-efficacy, and Self-perception is Reported to Increase

Finally, several studies discuss the positive impact of working as a TA or peer leader related to the perceptions, efficacy, and confidence of those who have such an experience. For example, Chapin et al. (2014) reported that students served by both UTAs and GTAs held a

positive perception of TA ability and attitude, although UTAs were perceived as slightly better than the GTAs at encouraging students and making them feel respected. Their work suggested that both UTAs and GTAs gain confidence and instructional skills (Chapin et al., 2014). DeBeck and Demaree (2012) echo this in their work with GTAs in a SCALE-UP environment, reporting increases in their confidence and experience. Their work examined GTAs with a range of experience levels and suggested that as experience increased, so did confidence and efficacy (DeBeck & Demaree, 2012). Marbach-Ad et al. (2012) reported similar findings based on a GTA preparation course, stating that GTA confidence and efficacy both improve with experience (Marbach-Ad et al., 2012).

Kendal and Schussler (2012) supported these findings and suggested that GTAs can develop professionally as the result of training and support during their time working as a TA. Professional development is believed to increase self-perception, self-efficacy, and self-confidence by developing relatability, engagement with students, and approachability, along with decreasing nervousness, uncertainty, and hesitation (Kendall & Schussler, 2012). While their work was specific to GTAs, it seems reasonable that the same would be true for UTAs and peer leaders. Weidert et al. (2012) echoed many of these same sentiments, stating that GTA perception of their own teaching behavior improved in many similar ways (Weidert et al., 2012).

Schalk et al. (2009) reported that the UTA experience offers benefits analogous to participating in undergraduate research, pointing out that the long-term benefits of undergraduate research are well-documented. The UTA experience improved participant teaching experience, communication skills, and self-confidence, as well as their leadership ability, even though the long-term impacts were an area identified as requiring further investigation (Schalk et al., 2009).

Reasons Students Choose to be Teaching Assistants

There is less empirical evidence documenting reasons why students chose to work as TAs, and several works here acknowledge this gap in the primary literature (Weidert et al., 2012; Wheeler et al., 2015). There are at least three factors contributing to this gap in understanding. First, the body of work surrounding GTAs is far more developed than work surrounding UTAs (Schalk et al., 2009). Graduate TAs, especially those in STEM fields, are often assigned teaching duties to meet departmental needs as part of their responsibilities. At times, this can mean that they are not working as a TA in a class that interests them or one that aligns with their specific career goals (Chapin et al., 2014). Second, because the body of literature surrounding UTAs is less extensive, there are fewer reports documenting ambitions, goals, and aspirations of UTAs prior to their experiences or the impact of those experiences (Schalk et al., 2009). Finally, many of the studies that do report reasons why students choose to work as UTAs are post-hoc or anecdotal in nature and lack formal documentation regarding why undergraduates are interested in such an experience (Drane et al., 2014). Of the studies that do discuss why undergraduates are interested in the UTA experience, there are five primary reasons identified. Students desire to develop professionally and emulate others who impacted their own learning as a way to explore potential goals such as graduate school or academic careers. Other reasons include financial incentives, reviewing content, and working with an impactful faculty member. It has been suggested that benefits in these areas persist both personally and professionally after graduation, but no work has empirically documented this (Snyder & Wiles, 2015).

Developing Professionally

Professional development is one of the most commonly identified potential reasons to TA throughout the primary literature. However, there are a number of issues with this topic

surrounding the lack of a precise and consistent definition (Drane et al., 2014; Marbach-Ad et al., 2012; Weidert et al., 2012). Chapin et al. (2014) illustrate the challenge of documenting this variable empirically quite well. Their work demonstrated that all undergraduates who were selected as UTAs had a strong interest in teaching and were subsequently receptive to training and support related to that role. This interest correlated to strong leadership skills in the classroom. Graduate TAs, however, were all aware of the teaching requirement that was an obligation as part of graduate school. Yet, many were uninterested in teaching, viewing it as a burden that decreased time they could allocate to their real interest in research. As a result, some GTAs were less receptive and less engaged in training or support for their teaching role. The authors discuss the difference in motivation between such viewpoints and identify it as a significant confounding factor when examining how much an individual may develop professionally. They note that this scenario is likely to exist at most universities where GTAs and UTAs are utilized but propose no solution for addressing it further (Chapin et al., 2014). Philipp et al. (2016b) echo this receptiveness and motivation to teach in their UTAs. They support the assertion by Chapin et al. (2014) that this difference in motivation is likely to lead to better outcomes not only in the students served, but also for TAs themselves, provided those TAs are motivated and receptive to training and support. Phillip et al. (2016b) also note communication skills as an important characteristic of professional development.

DeBeck et al. (2010) additionally reported that self-reflection as part of a weekly journal kept by TAs at both the graduate and undergraduate level contributed to their professional development. TAs at both levels were forced to confront their own biases and assumptions by documenting their own ideas prior to classroom sessions and then reflecting on those after teaching. Facilitating reflection upon beliefs and practices ultimately improved pedagogical

skills over the course of the semester. They argue that this change in beliefs and practices constitutes professional development (DeBeck et al., 2010). Drane et al. (2014) and Otero et al. (2010) reach nearly-identical conclusions in their work.

Marbach-Ad et al. (2012) set out to develop a preparatory course for GTAs that would improve their effectiveness specific to chemistry courses and subsequently evaluate the usefulness of that preparation (Marbach-Ad et al., 2012). One of their specifically stated objectives was to increase the professional development of their GTAs. Like other works, they failed to define professional development in a concrete or precise manner. Instead, they focus on three characteristics which they felt represented professional development. These included a sense of community, modeling effective and innovative pedagogy, and helping GTAs understand their roles. Essentially, they document an increase in all three of these characteristics by participating GTAs, and they conclude that this increase constitutes professional development by this group, many of whom expressed an interest in academic careers (Marbach-Ad et al., 2012).

Emulating Others as a Way to Explore Potential Future Roles

Exploring future roles as graduate students or careers in academia are also common points of discussion within many of these works. Several discuss UTAs expressing an interest in teaching at either the graduate level as they pursue graduate degrees, or as faculty pursuing careers in academia. Drane et al. (2014) argued that teaching is especially important in light of shortage-concerns surrounding STEM disciplines (Drane et al., 2014). Chapin et al. (2014) and Philipp et al. (2016b) both focus on this in reference to creating successful GTAs as the UTAs they worked with progress into graduate school (Chapin et al., 2014; Philipp et al., 2016b). Kendall and Schussler (2012) further discuss the effects that working as a GTA had on developing graduate students into effective future faculty (Kendall & Schussler, 2012). Otero et

al. (2010) extend these ideas even further to include producing competent K-12 science teachers, specifically ones able to teach physics and math (Otero et al., 2010). These works not only established the idea that there may be a pipeline from UTAs to GTAs to faculty, but also that serving as an UTA was perceived as likely to help students who may be interested in academic careers or teaching roles test the waters.

Financial Incentives

Three works examined here specifically address financial motivation as a potential reason for participation in a teaching assistant or peer leader program (Chapin et al., 2014; Otero et al., 2010; Philipp et al., 2016b). Chapin et al. (2014) and Philipp et al. (2016b) both acknowledged that UTAs are likely to be far less expensive for departments and institutions than GTAs because GTAs are more likely to receive a tuition waiver and a stipend in STEM disciplines. Undergraduate TAs on the other hand are likely to receive only an hourly wage, which equates to less money than the stipend of a GTA. Chapin et al. (2014) specifically caution against completely replacing GTAs with UTAs as a cost-saving measure, instead advocating appropriate use of both to augment and supplement support for students. These three works constitute a case that there is the potential for students to be interested in such an experience for financial reasons. Institutions may also view UTAs as a financially beneficial practice.

Content Review for Future Professional Reasons such as GRE or MCAT

Reviewing content commonly was discussed as a motivation to be an UTA, yet there were differing opinions presented on this topic from within the primary literature. For example, both DeBeck et al. (2010) and Chapin et al. (2014) worked with mixed pools of graduate and undergraduate TAs. DeBeck et al. (2010) concluded that UTAs (referred to as learning assistants or LAs in their work) were likely to struggle with content more than GTAs because they had

only seen the material once, while enrolled as students themselves. On the other hand, GTAs in their work likely had multiple exposures to the content because of their advanced academic standing. As a result, they propose that UTAs require more review of content matter to be effective. Chapin et al. (2014) presented a differing viewpoint. They reported that UTAs were more familiar with content, having been enrolled in the class recently. As a result, the material was fresher in their minds than to graduate students who were likely several-years-removed from the class and likely had taken the undergraduate course at a different institution. There is consensus in the literature however that reviewing the content of the class is reported by TAs at either level to make them feel a higher degree of mastery with course content as a result of their experience (Chapin et al., 2014; DeBeck et al., 2010). Kendal and Schussler (2012) support this claim in regard to GTAs in their work (Kendall & Schussler, 2012).

Work with a Faculty Mentor Who was Particularly Impactful

There is a broad range of support offered to TAs. This support can range from highly structured weekly meetings or seminars focused on pedagogy, to no support at all (Marbach-Ad et al., 2012). Kendall and Schussler (2012) make a case in their work that even in departments where instructional training and support is provided, GTAs still require more guidance in developing their pedagogical and instructional practices if they are to become truly effective in their roles (Kendall & Schussler, 2012). Marbach-Ad et al. (2012) echo this assertion in their work trying to help chemistry GTAs understand their role in the class, department, and university (Marbach-Ad et al., 2012). Specifically, both papers identified that working closely with a faculty member is the best way to develop delivery techniques specific to course curriculum within the context of a specific discipline. Additionally, GTAs can gain insights about course planning, assessment, interdisciplinary connections, instructional design, and teamwork through

such mentoring (Kendall & Schussler, 2012). There is far less work specific to UTAs or peer leaders. In any case, faculty members who are capable of mentoring students in such roles are likely to be perceived as highly impactful to their mentees.

Otero et al. (2010) noted that the trend toward utilizing UTAs has been expanding even beyond high enrollment intorductory courses. They note that at their institution, learning assistants, who are functionally the same as UTAs, were starting to be utilized in upper level advanced courses with smaller enrollments. Not only did students enrolled in the courses benefit from increased resources, the learning assistants appeared to prosper as well because of the opportunity to work closely with a faculty member. The benefits discussed included the building of a professional relationship that facilitates mentoring, the opportunity to review material, and increased buy-in from faculty and students alike, which led to more interest in expanding the program. In their study, a number of learning assistants reported becoming interested in teaching careers at some level because of their experiences, and the benefits they perceived such as self-confidence and the reward of helping others. They note that the positive perception of these learning assistants was directly tied to supportive mentoring faculty members (Otero et al., 2010).

Chapin et al. (2014) and Philip et al. (2016) both note the importance of the menotring that occurs between TAs and faculty members. Increased communication skills and motiviation are identified as important characteristics of successful TAs in both works, and Philipp et al. (2016b) especially emphasizes the importance of this. Their work surrounded a weekly cohort meeting between UTAs and faculty members. These meetings helped UTAs prepare for obstacles to success encounterd by students, which subsequently made the experience more

beneficial for all parties involved. It also documented the importance of a close working relationship between faculty members and TAs (Philipp et al., 2016b).

Long-Term Impacts of Serving as a Teaching Assistant

There have been repeated calls in the primary literature for more work investigating the long-term impacts of the UTA experience. Several of these speculate that documented short-term benefits experienced by UTAs persist after graduation and identify the need to explore this hypothesis. To date, such a long-term investigation has not been conducted (Drane et al., 2014; Schalk et al., 2009; Snyder & Wiles, 2015). However, as described in previous sections, there are a number of documented short-term impacts upon UTAs which include: increased communication skills (Drane et al., 2014; Snyder & Wiles, 2015), decreased intimidation and improved attitude and persistence in STEM fields (Chapin et al., 2014; Kendall & Schussler, 2012; Philipp et al., 2016b), mentoring and a sense of community (Chan & Bauer, 2015; Drane et al., 2014; Snyder & Wiles, 2015), improved self-confidence (Chan & Bauer, 2015; Chapin et al., 2014; Drane et al., 2014; Snyder & Wiles, 2015; Weidert et al., 2012), improved critical thinking and problem solving (Drane et al., 2014; Philipp et al., 2016b; Snyder & Wiles, 2015), increased ability to balance multiple responsibilities (Kendall & Schussler, 2012), and finally, enhanced professional development (Snyder & Wiles, 2015; Weidert et al., 2012).

Evidence of other perceived long-term effects was also sought. The semi-structured interview format of this study allowed investigative conversations to be conducted in a manner that generated data relevant to the characteristics described earlier in this chapter so that they could be effectively evaluated. It also allowed for flexibility that enabled interesting or novel facets of the experience to be explored, which were not identified in the literature review. Semi-structured interviews allowed for personalized responses from participants, which fostered

adaptive, dynamic follow-up questions that probed for meaning and understanding on the part of the investigator. The semi-structure interview format closely resembled the open-ended reflective questions previously used to explore perceptions related to the effectiveness of UTA training and support, yet with more follow-up (Philipp et al., 2016a). Interviews such as the ones utilized in this study have also been previously used to collect data documenting the short-term perceptions related to the UTA experience in several other works that relied on participant self-reporting (DeBeck & Demaree, 2012; DeBeck et al., 2010; Drane et al., 2014; Marbach-Ad et al., 2012; Schalk et al., 2009; Snyder & Wiles, 2015). With this established approach in mind, data collection for this study followed the structure of previous work that successfully and appropriately developed an understanding of similar questions on a short-term time line.

Limitations of Previous Works

Like this research, all of the works utilized in this literature review were conducted at single institutions, and many were conducted in single departments at those institutions. For example, DeBeck and Demaree's (2012) work and the Otero et al. (2010) work were both limited to a single physics department. DeBeck and Demaree's work collected data over four consecutive semesters before concluding and focused solely on GTAs. Kendall and Schussler's work (2012) was likewise limited to GTAs at a single academic institution in the Southeastern United States. Schalk et al. (2009) investigated UTAs, yet within a single semester, and solely from within their biology department. Chapin et al. (2014) was the first work that directly compared GTA impact to UTA impact on students. Their study demonstrated that UTAs were just as effective at positively influencing student-learning as GTAs (Chapin et al., 2014). That research was also conducted at a single institution, and part of their data relevant to the impacts on UTAs came only from a single academic quarter. Philipp et al. (2016) reached similar

conclusions as Chapin et al. (2014) shortly thereafter, determining that there was no practical difference in the effectiveness of their UTAs compared to their GTAs (Philipp et al., 2016b). Their work, like nearly all of those presented in this review, was conducted at a single academic institution. However, all of these works were limited to short-term time horizons. For example, Snyder and Wiles (2015) presented findings from a span of only 15 weeks within a semester, again from a single academic institution.

Additionally, sample size is a concern UTA programs tend to be small, limiting the prospective participant pool. Philipp et al. (2016b) based their work on only six UTAs and three GTAs within a single chemistry department. Marbach-Ad et al. (2012) based their work on a participant pool of only eight GTAs within a single department. Thompson (2010) generally advocates for a sample of 25-30 participants for Grounded Theory methodology yet notes that less-sensitive topics coupled with a researcher who is familiar with the topic can often achieve data saturation with smaller sample sizes (Thomson, 2010).

A number of the works used to construct this literature review explicitly state the need for more work related to the long-term impacts of the UTA experience (Drane et al., 2014; Schalk et al., 2009; Snyder & Wiles, 2015). Kendal and Schussler (2012) likewise call for additional intensive investigations regarding GTA characteristics over a longer time period building on their work (Kendall & Schussler, 2012). In the absence of research informing such an investigation, the afore mentioned studies served to formulate a semi-structured interview utilized by this study. This interview format sought to assess if former UTAs perceive long-term effects of their experiences and, if so, what those might be. Ultimately, 13 participants spanning a 10-year time frame provided interview data that was analyzed using a Grounded Theory approach. This far exceeds the short-term investigations previously established in the primary

literature and is appropriate for investigating the undocumented long-term effects of the UTA experience. The methodology used to accomplish this is discussed in Chapter III, the results of that analysis are addressed in Chapter IV, and Chapter V concludes with a series of recommendations and reflections.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to investigate perceptions related to the long-term effects of working as an Undergraduate Teaching Assistant (UTA). Previous studies have illustrated short-term benefits associated with such experiences yet are generally limited to a single semester or academic year, with speculation that postulates long-term benefits to UTAs as they enter careers in STEM fields. No empirical evidence has substantiated that these benefits are indeed perceived to persist in former UTAs as they progress into graduate school, professional programs, or careers.

Chapter III will include an overview of the methodological approach (Grounded Theory) used to investigate these perceptions about the long-term effects of working as an UTA. It will address the identification and selection criteria for participants involved in this investigation. Details pertaining to semi-structured interviews that were intended to generate data meaningful to such an investigation are also discussed. Additionally, data collection and analysis will be explained regarding techniques that were meant to ensure trustworthy, valid, and reliable conclusions drawn from such data. A copy of the letter that was sent as an invitation to participate through the U.S. Postal Service or by email, based on available contact information for each potential participant, is found in Appendix A. In Appendix B, an outline of the semi-structured interview which was also sent to potential participants is provided.

This research study provided novel understandings by addressing speculations from previous works in a number of ways. Specifically, participants in this study were all former

UTAs who graduated from the same Biology Department in the upper Midwest within the past 10 years. No other work has examined participants over such a long span of time. This time period allowed for many of these students to go on to graduate school, professional programs, or careers. Included in Chapter IV is a summary description of participants that includes what they transitioned to after graduation. Unlike other works, this study was not limited to a sample of participants who remained at the same institution where they completed their UTA experience, or who were still in their undergraduate course work. This participant pool was appropriate to the research question because the potential pool of participants allowed for long-term perspectives to have been developed. These participants were able to provide insight from the perspective of former UTAs about their perceptions of the long-term benefits that the UTA experience had on them, which had not been previously investigated.

Design of the Study

Because no similar work to this study was located as a guide, a Grounded Theory approach was utilized to investigate the perceived long-term impacts of working as an UTA. Grounded Theory follows a Constructivist epistemology framed within an interpretivist theoretical perspective (Crotty, 1998). To a lay-person, or someone without significant formal background in teaching and learning, this design means that the knowledge gained from this study was constructed by interpreting patterns from within the data. This data was generated through semi-structured interviews (see Appendix B), that guided a conversation with individuals who had experience working as an UTA and had since graduated with their undergraduate degree. Such experiences span10-years, allowing for reflective insight about the UTA experience to develop which has not been previously explored in other studies.

The flexible and adaptive nature of these interviews allowed for personalized responses by each interviewee which would not have been possible from a survey or other similar quantitative approach. It also allowed for insightful and adaptive follow-up dialogue with the researcher to clarify points of interest and probe interesting points that ensured adequate understanding. These interviews were recorded using audio equipment and transcribed into Word documents. These audio recordings and transcriptions were examined repeatedly and compared to each other as each subsequent interview was completed. Memos documenting evolving thoughts and ideas about the details of each individual interview, and in comparison to other interviews, were kept by the researcher in a journal. Codes were tentatively developed, and their meaning and organization were constantly refined throughout data collection. Appendices C through F provide detailed descriptions of each code, along with their organization by category for each theme identified by this research.

Qualitative software was initially utilized yet became overly burdensome because of limits to the number of documents that could be compared at one time. As analysis proceeded for each interview, it became clear that a separate document would be needed for each theme because of the complexity of the Personal Impact theme and the Professional Impact theme. For the final analysis, transcripts for these themes were converted into tables in Microsoft Word, then highlighted and coded manually. Notes were made in adjacent tables that allowed the researcher to document points of interest, make notations to himself, and document tentative thinking in an ongoing manner that supplemented the memos in direct relation to the text. This procedure allowed for easy comparison and reference among all transcripts. Highlighting was color-coded by category so that patterns could be visually identified, and repeating patterns of frequently associated codes could be effectively identified for examination. Microsoft Excel was utilized in

conjunction with this process to document the location and frequency of each code in each transcript for all four themes, and their subsequent categories. A final record of the location and frequency of each code, in each category, of each theme, for every participant, can be found in Appendices G through J. This process allowed for significant statements to be identified in each interview and then compared and contrasted with other respondent interviews in an ongoing compare-and-contrast method. While there is interpretation involved in the construction of meaning from these interviews, this compare-and-contrast method was accepted as both reliable and valid in qualitative research because it is believed that most people will reach similar conclusions based from within the data as presented here (Crotty, 1998; Glaser & Strauss, 1967; Saldaña, 2009).

This process of constructing knowledge from within the data based directly on the perspectives of former UTAs allowed the investigator to develop an understanding of how the experience was perceived to have impacted their values and beliefs (Crotty, 1998; De Welde & Laursen, 2011; Eisner, 2017; Fielding & Fielding, 1986; Glaser & Strauss, 1967; Glesne & Peshkin, 1992). Themes are significant repeating patterns from within the data and are generally identified and constructed from pinpointed significant statements that are similar amongst interviewees. These individual significant statements are identified and assigned a code, which is usually a single word or short phrase that summarizes the statement for identification later. For example, many UTAs talked about how the experience allowed them to connect with or relate to interviewers during their application process to medical school, dental school, and graduate school. Such statements within each interview were subsequently coded with the term "interview". That code became part of a larger category "professional development" within the Professional Impacts theme. As an illustrative example, codes within this theme were

highlighted purple in the transcript used for analysis. Codes for the "Experience" theme were highlighted in grey. After all codes had been labeled and highlighted, each transcript was visually examined for repeating associations of these highlighted colors. The regular occurrence of purple (professional development) codes with grey (experience) codes resulted in the arrow between these respective categories in Figure 7 that illustrated the Professional Impacts theme. Illustrative quotes of this association were identified and provided in the discussion of each such relation in Chapter IV.

Constructing these understandings was accomplished through a process of continual data sampling, coding, categorizing, comparing, and tentative theory-building that tested emergent concepts (Glesne & Peshkin, 1992; Wilson et al., 2012). Continual data sampling means that as these interviews were conducted the investigator transcribing them attempted to identify significant statements and labeling them with a code. These codes were categorized in an ongoing and tentative nature and documented in memos initially. As the data set grew and transcription progressed, the tables became more and more critical to document and record tentative coding that could be compared to other interviews. As more interviews were conducted, and the information gathered, transcribed, and coded, there were several times when codes needed to be recategorized based on the developing categories and tentative, dynamic nature of the understanding that was constructed. Continual resampling, coupled with ongoing compare-and-contrast work allowed the investigator to continue identify, examine, and categorize codes into larger groups indicative of major points of interest common to the growing sample of interviewees.

Analytic memoing allowed the investigator to document and summarize his thinking following each interview. These memos were regularly revisited as subsequent interviews

occurred because they provided a good summary of tentative thinking related to each interview. However, the excel tables discussed above correlating the exact codes, location, and frequency were equally beneficial if not more-so, because they allowed the investigator to quickly pinpoint features of interest, thinking related to that point, and compare it to other relevant points. This process is what ultimately led to the conclusion that a point of data saturation had been reached following the 10th interview, because no new codes or themes emerged (Wilson et al., 2012). Three other interviews had already been scheduled, and these were conducted, and their data included, which confirmed saturation.

Analytic memoing is essentially an ongoing record by the investigator about what they have done every time they work with the data, much like a field journal. It allowed a record of tentative development and understanding to be documented, monitoring personal progression, recording hypotheses and noteworthy points of interest, and keeping track of progress during the process of data collection and interpretation as sampling and re-sampling of the data occurred by comparing and contrasting multiple interviews. Such ongoing re-sampling allowed for sufficiently valid and reliable findings based on constant comparing and contrasting of the data and tentative analysis (De Welde & Laursen, 2011; Graham, Frederick, Byars-Winston, Hunter, & Handelsman, 2013; Wilson et al., 2012). This ensured a systematic approach to identifying codes within and across multiple interviews as the number of transcribed interviews increased, and the investigator identified points of interest within them. It also allowed for systematic investigation as new points of interest as they arose, and the researcher re-examined previous interviews for evidence of such insight that may have been less-obvious or un-identified in previous examinations of the transcript. In other words, one interviewee may say something that the investigator realized was significant. When this happened, the investigator went back to

other previous interview transcripts and compared and contrasted them with the current one to see if there was evidence of a similar significant or insightful point of interest. This was all documented in the transcripts and summarized using analytic memos to keep track of the findings, and the tentative, ongoing nature of understanding that was built from this ongoing process. Such a process ensured that the investigator was systematic about his approach to identifying points of interest, and made reasonable inferences based on his interpretations. It also allowed him to determine that he had reached a point of data saturation when no new points of interest arose from three additional subsequent interviews.

These analytic memos also allowed the researcher to be reflective about the ongoing process of knowledge development and to document progress and thinking within the documents themselves. Because context matters so much to the appropriate construction of knowledge in qualitative research, it was critical that a systematic approach be taken and maintained as the data was collected and analyzed. Analytic memoing has been called one of the most effective tools for maintaining this systematic approach, helping ensure trustworthy, reliable, and valid conclusions (Saldaña, 2009). These memos contributed significantly to the reflexivity section of chapter 5 of this dissertation.

Saldana (2009) summarizes the methodological approach of Grounded Theory as one that utilizes a systematic approach through a series of cumulative coding cycles that results in the development of theory rooted in the data itself (Wilson et al., 2012). Briefly, first cycle coding (in vivo, process, and initial coding) fractured or split data into individually coded segments. Second cycle coding (focused, axial, and theoretical) then constantly compared, reorganized, and focused the initial codes into categories that can be prioritized to develop axial categories around which core codes and themes revolve that illuminate the interrelationship between codes, themes

and categories with perceptions, values, and beliefs (Wilson et al., 2012). Once these categories emerged, properties and dimensions of each can be developed in order to construct an understanding about their attributes, and the resultant dimensions associated the qualities that make them relevant. Analytic memos are the engine that generates these codes and tease out such properties and dimensions by documenting hypotheses about connections between categories, codes, and themes within the data that the investigator was able to reflect on as the data set was built through the constant comparisons from within the emergent data (Wilson et al., 2012).

Selection of Participants

The Biology Department at the Midwestern research university selected for this study acted as a gatekeeper in assisting with this investigation by producing contact information from individuals who worked as UTAs within that department over the last 10 years, and who had subsequently graduated. Invitations to participate were sent to all of these individuals, asking if they would be willing to take part in an interview about their previous involvements as an UTA, and discuss how that had impacted their subsequent experiences and development since graduating. A draft of that invitation is attached as Appendix A. For individuals whose email was available, this inquiry was sent electronically. If a physical address was available (yet no email address), this inquiry was mailed via the U.S. Postal Service. If neither was available, but a phone number was provided, then a phone call was made asking if the former UTA would be willing to set up a time to participate. The option to Skype that was approved in the IRB was never used because all participants either wanted to meet face-to-face or talk over the phone.

Individuals who were willing to participate were contacted at their preferred day and time by their method of choice. Following introductions and a brief explanation of the project, verbal

consent was confirmed to record the semi-structured interview using audio recording equipment. A semi-structured interview was then conducted that asked a series of scripted questions, with dynamic and adaptive follow-up discussion to probe for insight related to each participant's responses. The outline of the semi-structured interview is attached as Appendix B.

It needs to be documented that the investigator had worked at this institution since 2011, and five of the former UTAs who participated in this investigation worked with that investigator across this time period. One of these participants was also an UTA in another class as well. There does not appear to have been a selection bias because there was not a disproportionate number of former UTAs who worked with the investigator and were subsequently willing to participate. It is also worth noting that the investigator had personal contact information for a number of former UTAs whose information provided by the department was not accurate. However, only information provided by the department was used in an effort to avoid selection bias.

There is documented concern related to investigators being "too close" to a topic or having a personal interest in a topic which they research, and such proximity resulting in biased findings. This concern is countered by a view that proximity to a topic may allow for more meaning and insight to be gained because of the time that the investigator has spent with these potential participants. Such familiarity may allow for nuanced understandings or insight about a phenomenon (Hatch, 2002).

Guiding Research Question and Qualitative Interviews

The overarching research question that guided this qualitative investigation was: "What are the perceived long-term effects of working as an Undergraduate Teaching Assistant in biology?" Semi-structured interviews were utilized to gather data relevant to understanding the

perceived long-term impacts of the UTA experience from the perspective of former UTAs using a Grounded Theory approach. This work was based on self-reporting by individuals about their own memories and reflections, which spanned as far back as 10 years. The theoretical perspective from which these memories and reflections were viewed was interpretivist in nature, because the responses from the interviewees as individuals were compared and contrasted with the responses of other interviewees to shed insight and develop an understanding about the perceived long-term effects of the UTA experience (Crotty, 1998). Development of that understanding required interpretation and inference-making on the part of the investigator and was based on data that at times required inductive and/or deductive reasoning to understand (Crotty, 1998; Maxwell, 2012).

Semi-structured interviews

The semi-structured interview format occurred in two parts as outlined in Appendix B. The semi-structured interview format allowed for consistent organization and flow among interviews that made subsequent comparison and contrasting more effective. It also allowed for flexibility and the probing of points of interest that arose related to potentially significant topics (Felege, Hahn, Hunter, & Gleditsch, 2016; Roulston, 2010). The first section of the semi-structured interview sought to achieve an understanding of the broad perspectives and general demographic data from each interviewee by asking approximately 20 questions meant to gather background and demographic information about each individual. The second section then sought more open-ended responses related to perspectives and perceptions of the participants by seeking information about experiences relevant to their time since working as an UTA, and the perceived impact of that experience on subsequent aspects of the participants lives. This structure was meant to allow for the contextualization of the data regarding perceived long-term

experiences of UTAs in a manner that allowed for the triangulation of meaning from within the data. Triangulation means checking an inference or deduction in multiple ways that confirms appropriate interpretations have occurred. This approach ensured trustworthiness of subsequent interpretations without leading or biasing respondents toward a given answer or perspective, such as a positive or negative outlook (Maxwell, 2012; Roulston, 2010; Wilson et al., 2012). Such efforts contributed to trustworthiness, validity, and reliability of inferences and interpretations drawn from that data, because they allowed for confirmation of statements and accuracy of interpretation on the part of the investigator (Crotty, 1998; Maxwell, 2012; Roulston, 2010; Wilson et al., 2012). For example, no participant indicated that his or her UTA experience was positive but contradicted such a position during their interview. Instead, statements about how beneficial the experience had been were consistently supported with details that confirmed positive perspectives throughout each interview.

Interviews were conducted face-to-face when possible if interviewees were located close to the city where the investigator was located, and if participants were willing/able to meet. If they were not available, but were still willing to provide an interview, then a phone conversation was conducted. These interviews and all subsequent transcripts, analytic memos, and other relevant documents were saved on the computer of the investigator and backed up regularly on both an external hard drive and utilizing a Dropbox account. Access to all of these accounts was password protected to ensure that privacy was maintained, while at the same time protecting data and the integrity of the evolving work.

Analysis of Data

The sample of interview participants included 13 former UTAs who agreed to participate following contact. Data saturation was determined to have been achieved following the 10th

interview because no new codes, categories, themes, or relationships emerged during interviews. However, three additional interviews were conducted because they had already been scheduled. These additional interviews confirmed that data saturation had indeed been achieved (Crotty, 1998; Wilson et al., 2012). This sample is smaller than some Grounded Theory experts advocate. Nonetheless, it is still acceptable because the topic was not considered to be sensitive, there was a clearly defined scope to the research question, and the interviewer was familiar with the topic. All of these factors have been shown to influence the number of participants needed for data saturation to be achieved (Thomson, 2010).

Interviews were recorded and transcribed to generate a data-set related to the long-term perceptions of former UTAs related to the impacts of their experiences. All interviewees were provided with a copy of the transcript of their interview within two weeks of the interview and encouraged to verify them for accuracy. This procedure was followed to ensure reliability of the data, as well as to promote transparency by the investigator. First cycle coding, coupled with regular analytic memoing and documenting of emergent codes in the associated excel tables were carried out on an ongoing and iterative process throughout the first stage of the investigation to generate emergent codes and themes from within the data (Maxwell, 2012; Wilson et al., 2012). These analytic memos were constantly compared and contrasted with each other as the data was gathered to generate categories of similar codes. Properties and dimensions within these categories were at the core of the long-term perceived values and beliefs surrounding the impacts of the UTA experience (Wilson et al., 2012). As these categories emerged, properties and dimensions of those categories were identified and developed from significant statements within the interview data. Specific sections of that raw data, which were particularly illustrative as "significant statements," were identified and documented so that they

could be revisited for refinement of understanding later on as part of the second cycle coding. Many of them became illustrative quotes used to show relationships between categories or properties of codes in Chapter IV.

Information grounded in the data itself supported the trustworthiness, validity, and reliability of inferences and conclusions that were drawn from the comparison and contrasting of the data that generated theses codes, categories, and themes as discussed in Chapter IV (Crotty, 1998; Maxwell, 2012; Roulston, 2010; Wilson et al., 2012). These comparisons provided insight about the perceived long-term impacts of working as an UTA that related to the interests and values of those who experienced it, what they gained from being an UTA in relation to what they anticipated from the experience, and how it has shaped them personally and professionally since they participated as an UTA during their undergraduate careers. It also served to refute concerns from within the primary literature. Strauss and Corbin (1998) concluded that most works conducted using a Grounded Theory methodology fail to generate novel theory. Nonetheless, that does not diminish the value of the understanding garnered from such work. That was the case in this study, because this approach did not generate new theory, yet it did build an understanding of the perceived long-term impacts of the UTA experience, which was the goal of the original research question (Strauss & Corbin, 1998).

Qualitative Rigor

Ultimately, the goal of any research is to generate a rigorous understanding about a situation that might otherwise remain enigmatic or confusing (Eisner, 2017). Care has been taken at each step of this investigation to ensure the highest level of trustworthiness, reliability, and validity possible. Ethical guidelines established by the university Institutional Review Board (IRB) have all been carefully adhered to by the investigator. Each interviewee was provided

with a copy of the transcript from their interview and encouraged to examine it for accuracy and provide feedback about any concerns, questions, or inaccuracies. Prior to each interview, time was taken to explicitly describe the study, associated risks (which were minimal), benefits, and implications of the work. Significant efforts were made to clearly and explicitly state the right to withdraw at any time for any reason, and to emphasize that participation was completely voluntary. Every effort has been made to maintain confidentiality and to keep identifying information private. All IRB standards have been followed in an effort to maintain the highest level of trustworthiness possible, with the hope that this study invited open, honest, meaningful dialogue during interviews, thus contributing to subsequently reliable and valid interpretations based upon the data (Crotty, 1998; Maxwell, 2012; Roulston, 2010).

Additionally, every effort has been made to identify biases through careful reflection in the analytic memos. Debriefings were conducted several times with the PhD advisor and one committee member with whom the investigator has worked with on another project. Every effort has been made to ensure the trustworthiness, reliability, and validity of all data and subsequent interpretations about understanding the long-term effects of working as an UTA by those who have participated in this experience (Crotty, 1998; Glesne & Peshkin, 1992; Maxwell, 2012; Roulston, 2010). Specifically, Appendices C through F detailing each code within each category, and Appendices G through J documenting the location and frequency of every occurrence of every code, in every transcript, by every participant, have been provided as evidence of this rigor.

Unpacking Important Terminology and Concepts to Establish Rigor

In an effort to increase the relatability and relevance of this work to a broader audience, and to increase the likelihood that it will be more widely received, there are a number of

important technical terms that have relevance and are worthy of explanation. The following section is intended to address these terms so that this work becomes more relatable to a broader audience and to illustrate how and why the technical concepts they represent are important to the interpretations, meanings, and understandings that are to be developed.

Critics of qualitative work have historically been reluctant to accept the trustworthiness of research conducted through a qualitative lens (Guba, 1981; Lincoln & Guba, 1985; Shenton, 2004). However, frameworks for establishing the rigor of such qualitative work have gained considerable momentum by demonstrating that qualitative work can and does meet criteria that ensures the reliability, validity, and ultimately, trustworthiness of qualitative findings. (Glaser & Strauss, 1967; Guba, 1981; Lincoln & Guba, 1985).

Reliability

Traditional quantitative researchers tend to think of reliability as a synonym for repeatability (Glesne & Peshkin, 1992). In both quantitative and qualitative contexts such as this work, reliability can be thought of as how consistent results are likely to be over time, and how accurately those results represent the entire population being studied (Golafshani, 2003; Maxwell, 2012). Replication is critical to any scientific approach, and in the case of qualitative work, reliability encompasses both internal and external measures that contribute to the repeatability of any work, so that others may confirm or reject reported findings (Guba, 1981). Internal reliability is often referred to as *credibility* and deals with how well the findings align with reality within the sample. External reliability, on the other hand, deals with the *transferability* of the work, and how generalizable findings from the sample are to a broader population from which the sample arises (Guba, 1981; Shenton, 2004). *Credibility* and *transferability* are two of the foundations of establishing trustworthiness in qualitative work

(Guba, 1981; Shenton, 2004). Appropriate research methods such as interviews, familiarity with the topic and the data, qualified experience by the investigator, appropriate sampling, frequent debriefing, scrutiny, and examination of previous work have all been shown to ensure that qualitative work conducted appropriately does indeed meet the criteria for reliability, and as such can be considered trustworthy (Guba, 1981; Lincoln & Guba, 1985; Shenton, 2004). Every effort has been made here to communicate the procedures that were followed to generate this data set, to describe how that data was analyzed, and how analysis was conducted. These descriptions should ensure that procedures from this study can be repeated should others choose to attempt similar work, and so that readers can determine the appropriateness of this approach. Likewise, Appendices C through F provide descriptions of all codes within each category and theme to ensure clarity in communication. Appendices G through J document the location, frequency, and occurrence of each code in each interview transcript so that readers can assess for themselves if this work has appropriately reached the conclusions presented here, as illustrated in Figures 4 through 16.

Validity

The concepts of reliability and validity are often closely related and intertwined in qualitative research (Maxwell, 2012; Shenton, 2004). Because of the interactive nature of qualitative work, where the investigator is often involved directly with the study participants, there is a focus on the researcher as well. For example, if another researcher examined the data from the sample of a qualitative work, and reached similar conclusions, or if another sample from this population were taken and similar results were obtained, then the work would be determined to be both valid and repeatable (Glesne & Peshkin, 1992; Golafshani, 2003; Maxwell, 2012). Like quantitative work, qualitative work strives to be repeatable by other

investigators. This repeatability ultimately encompasses the researcher as well because of the interactive nature that qualitative investigations often utilize such as interviews (Guba, 1981; Lincoln & Guba, 1985; Shenton, 2004). In qualitative work, this concept of validity is often referred to as *transferability*. The emphasis is on detailing the process of investigation so that others may evaluate the appropriateness of such work and replicate it. This detailed procedure allows others to evaluate and assess the work for strength and appropriateness, as well as to evaluate the credibility and transferability of such conclusions that may be reached (Guba, 1981; Shenton, 2004). Essentially, if a work is valid, it can be trusted, and findings generated by following a similar procedure can be transferred dependably to make predictions about either a larger population or other groups experiencing a similar phenomenon (Shenton, 2004).

Questions of validity in qualitative research can essentially be thought of as reasonable alternative explanations that may also explain what is going on based on the data, and how well the research measures the construct, notion, idea, or question which it set out to measure (Glesne & Peshkin, 1992; Golafshani, 2003; Maxwell, 2012). Like reliability, there is a focus on both the process and the product, with an emphasis on both the sample and the researcher (Golafshani, 2003; Lincoln & Guba, 1985). The sample selected should be an appropriate representation of the larger population in question. The researcher should attempt to remain as objective as possible and to ensure that findings which emerge are based on the data, not their own predispositions or biases, while conducting as thorough an investigation as possible (Guba, 1981; Lincoln & Guba, 1985; Shenton, 2004). The process of exploration should seek to identify information that accurately depicts information in a manner that can provide understanding and be used to explore alternative hypotheses or explanations by other researchers looking at the same data, or others using the same process to examine other relevant, appropriate phenomenon.

Outlined in Appendix B are the semi-structured interviews used to generate transcript data in this investigation. In Appendices C through F, codes related to the organization within each category and theme are presented. Documented in Appendices G through J are the occurrence of these codes in an effort to be fully transparent so that readers may determine for themselves if the approach, analysis, and subsequent conclusions here satisfactorily explore alternative explanations or hypotheses and can thus be considered valid. Chapter IV presents the findings of this study, supported by representative quotes and descriptive reasoning, which further substantiates the validity of this work.

Confirmability

The focus on other researchers reaching similar conclusions is a concept which Lincoln and Guba referred to as an "inquiry audit" (Lincoln & Guba, 1985). Inquiry audits emphasize both the process and the product as a way to evaluate how a researcher carried out an investigation. The quality of the product and conclusions that researchers present to convince an audience that their final products are worth paying attention to (Lincoln & Guba, 1985; Shenton, 2004). Works that are high in quality are those which convince others that they would reach similar conclusions when presented with similar data from similar samples of the same population. This principle in qualitative work is known as *confirmability*, and is closely tied with credibility, transferability, and dependability, because high quality works demonstrate each of these characteristics in an intertwined manner (Shenton, 2004). Every effort was made in this study to present summarized data and findings in a manner that enhances confirmability of this work to other readers.

Triangulation

Chance association and systematic bias are two dangers that need to be considered in any research undertaking (Maxwell, 2012; Shenton, 2004). Collecting information from an appropriate range of individuals and examining that data from different perspectives are two ways to avoid threats to chance and bias that might challenge the credibility, dependability, and confirmability of findings through such error or bias (Fielding & Fielding, 1986; Maxwell, 2012; Shenton, 2004). This process also ensures the transferability of findings when appropriate to broader populations. Here, *triangulation* meant the collection of viewpoints and experiences from a range of informants so that those descriptions by participants can be confirmed within their own interviews by comparison to other sections, and that experiences can be verified against others by constant comparison to similar experiences. Ultimately, the goal was to produce an understanding about the attitudes, perceptions, needs, and behaviors of the group being studied, which here were UTAs (Shenton, 2004). Specifically, Appendices G through J are presented as evidence of triangulation among participants. Quotes in Chapter IV are provided to illustrate key features of interviews that triangulated date both within and between interviewees.

Honesty of the Interviewees

A number of steps have been shown to increase the honesty of participants in qualitative research. Honesty is important because participant responses form the basis of the raw data in studies such as this one which utilized semi-structured interviews. Providing the opportunity to refuse to participate and allowing participants to withdraw at any time ensures that only those who are genuinely willing to take part offer data. Participants should always be encouraged to

be frank and honest at the onset of each interview session, and as Appendix B shows, this was explicitly discussed at the onset of each interview.

Rapport with the researcher has also been shown to increase participant honesty and response detail, because it allows participants to contribute ideas and talk openly about their experiences without fear of misunderstanding or misinterpretation. Every effort was made within the interview to build this rapport with participants. Strategies for doing so included asking participants to tell more, restating information to ensure accurate understanding, and demonstrating genuine interest in participant experiences.

Additionally, iterative questions were used that probed for detailed data in an attempt to uncover apparent contradictions, falsehoods, or discrepancies if they occurred. The IRB also approved contacting participants again if clarification in the initial interview was not satisfactory. No participants needed to be re-contacted for clarification in this study.

Finally, allowing participants to review their transcribed interviews and provide feedback about the accuracy of such documents also has been shown to ensure honest and accurate raw data. Every participant in this study was given that opportunity (Shenton, 2004). None replied with any identification of errors or other issues.

Generating a Trustworthy Understanding

High quality works are those that meet the criteria above in order to reach a trustworthy conclusion through an appropriate process. The researcher's knowledge and experience with UTAs made the individual uniquely qualified to carry out this investigation and gain novel insight that was previously unexplored regarding the long-term effects of working as an UTA. His rapport with individuals who have experience in this role made it possible for him to gain insights that a novice outsider unfamiliar with the logistics and duties of UTAs may not have

been able to glean. Likewise, his experience contributed to insightful and dynamic probing through semi-structured interviews that confirmed honesty within individual respondent interviews, as well as similarities and differences between interviewees and their experiences. This research study met the criteria for internal reliability because of the compare-and-contrast approach advocated by Grounded Theory to examine these interviews in a way that generated meaningful understanding from within the data itself (Glaser & Strauss, 1967).

Standards for external reliability were met by following adequate procedures within the semi-structured interviews that provided each participant with a set of guiding questions yet allowed for flexibility. In several cases unique and meaningful facets of each participant's experiences were uncovered. This helped to confirm the accuracy and honesty of their responses (Shenton, 2004). Furthermore, the compare-and-contrast approach advocated by Grounded Theory ensured credibility of findings as similarities and differences between experiences and outcomes were discovered in the initial interview data, and subsequent ongoing analysis. This ongoing compare-and-contrast approach further ensured the credibility and dependability of such findings.

Analytic memos and regular documentation of each step of this process were recorded and consistently compared. Immediately following each interview, an analytic memo was generated documenting initial ideas and hypotheses to explore. As the interviews were transcribed and coded, initial points of interest were recorded in these analytic memos. Detailed descriptions and tentative thoughts were noted in the documents. Further memos, recording categories and potential themes that emerged from the data were constantly proposed, evaluated, and confirmed or rearranged as understanding progressed. That understanding was tentative and dynamic, and the evolution of this thinking was consistently recorded and documented as codes,

categories, and themes emerged. This organization was compared and contrasted to explore the relationship between the UTA experience and perceptions by former UTAs about how that experience impacted them after graduation. Summarized data from every transcript showing the location and frequency of each code in each interview is provided in Appendices G through J to further illustrate the transparency of this investigation. Illustrations, representative quotes, and relevant discussion surrounding the conclusions reached based on this data are included in Chapter IV.

Limitations

There are a number of potential limitations that this work faced. First and foremost is the pool of potential participants. The group was limited to approximately 70 potential participants. Following approval of the study, only 58 of these individuals were found to still have working contact information. Of these, 14 voluntarily participated, of which only 13 actually met the criteria for inclusion, because one was mislabeled as an undergraduate when they were actually a graduate student at the time they worked as a TA. All 13 of these participated in the UTA experience within a single department at a single institution in the upper Midwest.

Participant age ranged from 22-33 years of age who worked as UTAs during their sophomore, junior, senior, and self-described super-senior years. Time since completing the UTA experience ranged from two to ten years. There was no apparent difference between any of these academic levels at the time of the UTA experience, or in time elapsed since completing the experience. Five participants had experienced the role of UTA with the investigator. There was no apparent difference in the findings of these five compared to the rest of the group. There was a mix of experience as an UTA in lecture, lab, or both, with only one individual who was an UTA in lab alone. This was too small a sample to make meaningful comparisons with the rest of

the group, but in general, UTAs with experience in both expressed benefits of working in lab and lecture. Note that all UTAs who worked in a lecture did so in an active-learning high-enrollment SCALE-UP classroom (R. Beichner, 2008). All participants here were Caucasian. While data saturation appeared to have been achieved, there is the chance that this sample does not present a representative sample of the broader population. Indeed, it is likely that UTAs are not representative of the general student population because faculty consistently select high-functioning students whom they have experience with (Chapin et al., 2014).

While such a sample may contribute to the consistency of the reported experience, it also may limit the findings and implications because this sample may not be representative of a broader population at other institutions around the country, or the potential pool of participants may be small. It is believed however that this sample is representative because participants consistently explained how and why they were selected to work as UTAs in a fashion that aligned with Chapin et al. (2014). This was based on academic performance and experience with faculty in a class of interest, which is likely to be consistent across departments and other institutions. The size of the sample is believed to be adequate because the interviews were high in quality with dynamic dialogue that allowed probing by the investigator. Additionally, the topic was not sensitive in nature, there was a clearly defined scope to the research question, conversations were on-topic related to that scope of investigation, and the interviewer was familiar with the topic (Thomson, 2010). Data saturation was reached three participants prior to the conclusion of interviews, but those additional participants were still included in the analysis. Because this topic was unlikely to be controversial or sensitive, it was more likely to achieve data saturation with this smaller group, which would allow for appropriate development of an

understanding of the properties and dimensions that are perceived to be impactful related to the experience of working as an UTA (Thomson, 2010).

It is worth noting that these 13 participants served as UTAs a total of 24 times. Six participants worked as UTAs a single time in the department, three worked as UTAs twice in the department, and four of them worked as UTAs three times in the department. Interviews were carried out in a manner that attempted to delineate perceptions related to each experience when participants had multiple UTA experiences. With this in mind, the generalizability of findings here may subsequently be constrained, and readers should evaluate for themselves if findings are transferable to outside situations at other institutions. At the same time, readers should evaluate for themselves if the data presented leads them to trust the conclusions drawn about the experience of participants in assessing the validity and reliability of this work (Guba, 1981; Shenton, 2004). However, every attempt has been made to present that data in a manner that facilitates evaluation by the reader with the hope that this work does indeed withstand such scrutiny.

The next limitation that this work faces is in the fact that the investigator has worked with five of the individuals who participated in this investigation. Five of the 13 participants worked with the investigator as UTAs within the past six years. One of those five worked as an UTA with another member of the faculty in another class, while four of the participants worked exclusively with the investigator. This presents two possible challenges. First, the investigator may be emotionally attached or close to this topic, leading to biased interpretation (Golafshani, 2003). Second, the participants may be emotionally attached or feel a personal connection with the investigator in a manner that biases their responses or makes them feel obligated to provide responses that only present aspects of their experiences which they think the investigator is

interested in, for example only discussing positive or beneficial aspects (Golafshani, 2003). Such biases would severely impact the trustworthiness and validity of the data, and subsequent reported findings. It is believed that this is not the case here because participants who were UTAs with the investigator did not present any different perspective than the rest of the group. Information on each participant is included in Chapter IV, and Appendices G through J present the location, frequency, and occurrence of codes within each transcript. There does not appear to be any sub-set of this sample that expresses a different perspective than the group as a whole, but that data is presented in the appendices to promote transparency so that readers may draw their own conclusion.

To prevent bias, a number of measures were taken. First, the semi-structured interviews were constructed in a fashion that asked participants explicitly about both positive and negative aspects of their experiences. An outline of the semi-structured interview is included as Appendix B. Second, during interviews, participant confirmation was sought by asking participants to confirm statements or meanings, and by the interviewer restating various points and asking for confirmation and/or clarification to confirm appropriate interpretation and understanding. Next, during analysis, the constant-comparative method was used to compare interviews with each other to identify patterns across participants in order to generate codes. Careful examination was given to each segment of text that was assigned a code to ensure that there were not contradictions within any participant's interview.

For example, if a participant had stated that working as an UTA developed their self-confidence, but later related stories of second-guessing themselves and feeling insecure, this would have created trustworthiness issues in the data, and any subsequent conclusions related to that data. Next, a table of codes and explanations of their meaning for each category within each

theme was developed so that readers could identify exactly what was meant by each code for each category within each theme to gain a sense of how codes were arranged into categories, and categories organized into themes. These can be found in Appendices C through F as Tables 1 through 4. Appendices G through J then document the location and frequency of the occurrence of each code within each category and organized by theme from within each interview. This summary of the data is provided to promote transparency so that a reader can gain a sense of where in each interview, and how often in each interview every code occurred. Finally, Chapter IV presents illustrative quotes coupled with discussion of how and why codes were organized into categories, develop the relationships between these categories, and describe how and why these categories were arranged into themes, leading to the final conclusions of the investigator. Figures 4, 10, 15, and 16 illustrate the codes, categories, and relationships of the four themes that emerged from this data. Figures 5 through 9, and 11 through 14 illustrate the relationships of the codes that were organized into each category based on that data.

This format and presentation was made in an attempt to maximize the transparency of the researcher with their audience, and to allow readers to evaluate and assess all aspects of the data and subsequent inferences and conclusions so that they could evaluate the reliability, trustworthiness, and validity of this work (Golafshani, 2003; Guba, 1981). A discussion of the codes, categories, and themes, along with illustrative quotes, and a discussion of inferences and reasoning surrounding the analysis is included in Chapter IV. Final conclusion and recommendations based on this work are found in Chapter V.

CHAPTER IV

PRESENTATION OF DATA WITH RESPECT TO THE LITERATURE

> Kevin : …it's really hard to separate a lot of the things from undergrad and how they prepared me for medical school because it all comes together. Like, synergistically – to be – *you are ready for medical school* – kind of thing. For me to pull off just part of being a TA is difficult, because it was being a TA, being a tutor, working at the hospital, going through all my courses. It was doing all of this stuff. And the overall outcome, I feel, from doing all of that, really prepared me for medical school. And there is obviously things in each of the things I did that helped, and things that were relevant to what I am doing now, but yeah – I don't think – there's not a doubt in my mind that TAing did have an impact. You know – being in and succeeding in medical school.

The purpose of this work was to investigate the perceived long-term impacts of the undergraduate teaching assistant (UTA) experience by participants who formerly worked in this role within the Biology Department at a large university in the upper Midwest prior to their graduation. Provided in Chapter III was a description of the Grounded Theory approach utilized in this qualitative investigation. Grounded Theory advocates that findings be grounded or rooted within the data itself. In the spirit of that methodological approach, this chapter opened with an illustrative student quote from a participant (Kevin) to contextualize the findings of this investigation.

Theory development was attempted following the transcription and coding of 13 participant interviews. This chapter will begin with a description of the participants and their self-reported accomplishments since graduation from that university. The identification and development of themes, categories, and codes will follow, along with

illustrative quotes where appropriate. A detailed description of the codes for each category is included in Appendix A as Tables 1 through 4. An illustrative figure is provided for each theme, modeling the codes and categories that comprise that theme. These models also illustrate the relationships among the categories of each theme. Furthermore, an illustrative figure modeling the interactions of codes, depicting the axial codes relative to other less-important codes, and illustrating these relationships for each category is also included. A discussion of each theme is provided to connect the categories of that theme to the relevant primary literature. The chapter will conclude with a discussion of the overall findings relevant to that body of primary literature.

Description of Participants

A list of 71 potential participants believed to have met the criteria of working as an UTA prior to their graduation within the last 10 years to the investigator in the Biology Department at the institution where this investigation took place was provided at the onset of this project. Of this list, 54 had functioning contact information, and 14 of them responded following contact by either email or phone and volunteered to participate. One of those was excluded from analysis because their information had been mis-recorded. During the interview, the individual reported that she was actually a graduate student when she worked as a TA. Participants included in the analysis included eight females and five males who collectively had worked as UTAs within the department a total of 24 times; six had a single semester of experience, three had two semesters of experience, and four had three semesters of experience. All participants were paid during their time working as UTAs. Current ages ranged from 22 to 30 years of age. Two participants were in medical school, two were in dental school, two were in graduate school, one had recently been accepted to graduate school, one had returned to school for another undergraduate degree, two were working in medical-related fields while applying for medical school, one had finished a

graduate degree (M.S.) and had become a supervisor within his field, one was working in Wildlife Conservation following the completion of her undergraduate degree, and one was not employed at the time of the interview, but had accepted a teaching position in a high school science department for the following semester (she had recently moved). Experience included working as an UTA in both labs and lectures. Four participants had served as an UTA in both labs and lectures, eight in lectures only, and one in lab only. All participants who had worked as an UTA for lecture did so in an Active Learning Environment SCALE-UP classroom (R. J. Beichner & Saul, 2003). Academic levels at the time of the UTA experience ranged from sophomore to senior, and three participants described themselves as "super-seniors" when they served as an UTA (super-seniors representing students who took five years to graduate from their undergraduate program). Additionally, all participants were biology majors, and four had double majored (two in science education, one in chemistry, one in psychology), and one participant specified that she majored in biology with a minor in chemistry. Five of the 13 participants had worked as UTAs with the investigator, and one of those had also worked with another member of the department.

Adam

At the time of his interview, Adam was a 23-year-old male in his second year of a master's degree program in biology at the university where this investigation occurred. He described himself as being born and raised in the same area where he had completed all his schooling. Adam graduated with his biology major from the same institution where he was pursuing his master's degree. He worked as an UTA one time during his senior year (2015) with the investigator. His UTA experience was in General Biology II, the large-enrollment active-learning second-semester introductory course for biology majors. Adam identified as having

also tutored during his undergraduate studies. He also carried out undergraduate research in two labs within the Biology Department. His stated career goal was to become a professor, and he articulated choosing to be a TA his senior year after being accepted to graduate school to test the waters and see how he would handle the teaching responsibilities of such a career. For his master's degree, Adam continued working in the two labs where he did research as an undergraduate, with both of those faculty members co-advising him through his Master's program of study.

Brian

Brian was a 24-year-old male in his second year of dental school in Arizona at the time of the interview. He was a former biology major who worked as an UTA twice, the first time during his junior year (2014), and again his senior year (2015). Both times were with Dr. Poplar (pseudonym) in the high-enrollment active-learning Genetics course that is typically taken by biology majors during their sophomore year. He did not discuss any tutoring experience, and explicitly stated that he did not participate in research during his undergraduate career. His stated reason for this was because his aspiration was always to attend dental school. Brian stated that he felt that research as an undergraduate did not align with that career aspiration but felt that being an UTA made him a better applicant for dental school.

Cassandra

Cassandra was a 24-year-old female. Originally from the Midwest, she was in her third year of dental school in Colorado at the time of the interview. She had majored in biology and worked as an UTA one time during her junior year (2014 with Dr. Euphorbia (pseudonym) in General Biology I lab and lecture. Cassandra described herself as being independently responsible for one lab section of approximately 30 students and attending the large-enrollment

active-learning course to help there as well. General Biology I is the first-semester Introductory course for biology majors. She did not discuss any experience tutoring or completing research during her undergraduate career. She had been interested in dentistry from an early age. She stated explicitly that she initially saw being a TA as a way to build her resume to become a more competitive applicant for dental school.

Danielle

Danielle was a 22-year-old female who had majored in biology with a minor in chemistry during her undergraduate career. At the time of her interview she was working as a licensed practical nurse with the U.S. Air Force while applying for medical school. She worked as an UTA one time during her sophomore year (2014) with Dr. Euphorbia (pseudonym) in General Biology I. This was the large-enrollment active-learning introductory course for biology majors. During her interview, she discussed insecurities related to her age, because she was almost always as young or younger than the students she was working for as an UTA. However, Danielle described the experience as having helped her become more confident and comfortable, and expressed that she came to see her knowledge and intellect as more important than her age. She expressed several times that she wished she had been able to work more as an UTA. Responsibilities as an Air Force Reservist who was also active in a sorority, and minoring in chemistry, never allowed another opportunity following her sophomore year. She did work as a tutor yet did not discuss any experience with research as an undergraduate. Her stated goal was to attend medical school, which she said she was applying to at the time of the interview.

Emily

Emily was a 24-year-old female from the Midwest who was working as a dermatology technician while applying for medical school at the time she participated in this interview. She

had an interview for medical school scheduled in January as part of her application process. During her undergraduate career, she had double majored in biology and psychology, participated in study-abroad, and usually worked 30 hours a week or more to support herself through school. She worked as an UTA one time her junior year (2015), with the investigator in General Biology II. This was the second semester large-enrollment active-learning Introductory Biology course for majors. She also expressed several times that she wanted to be an UTA more as an undergraduate, but her busy schedule and a limited number of opportunities prevented that from happening. She was unsure if she wanted to pursue medical school or go on for a PhD in biology to try and become a professor. She was leaning more toward medical school because she did not feel drawn to research, and as such, had not participated in any research experience as an undergraduate.

Faith

Faith was a 23-year-old female about to complete her master's degree in clinical pathology. From the Midwest, she attended the university where this investigation took place, and was originally a business major before switching to biology and then going on for her master's degree. She and her advisor intended for her to complete a PhD initially, yet Faith was also about to get married, and her fiancé had accepted a job in another city. As a result, she did not want the first years of their marriage to involve a distance relationship. Faith worked as an UTA three times, once during her junior year (2014), and twice during senior year (2015). All three of these were with the investigator, and all in Concepts of Biology, the introductory biology course for non-majors. (Note, this course does substitute for General Biology II, if students take it before declaring a biology major). Faith also worked as a tutor during her undergraduate career and participated in undergraduate research. She described the teaching

assistant experience as one of the main reasons she became and remained a biology major. The lab where she was completing her master's degree was also the same one where she completed her undergraduate research.

George

George was a 24-year-old male from the Midwest who had double-majored in biology and chemistry as an undergraduate. He had worked as an UTA twice, the first time during his sophomore year (2014), and the second time during his junior year (2015), with Dr. Euphorbia (pseudonym) in General Biology I and II, the first and second semester Introduction to Biology I and II major's courses taught in high-enrollment active-learning environments. George also tutored and participated in research during his undergraduate studies. At the time of his interview, he was applying for PhD programs in the natural resources at multiple universities. Shortly after the interview he accepted the opportunity to pursue his PhD at one of those universities. George expressed a strong connection to the outdoors, spending four months of every year at his family's cabin. He described this time as highly impactful in his connection to the natural resources, and influential in his decision to pursue a PhD instead of going to medical school (which was his intent when he first came to college). At that time, George was a chemistry major, yet chose to double major in biology and chemistry following his experience with Dr. Euphorbia (pseudonym) in his own Introduction to Biology courses in his freshman year. George was explicit that working with Dr. Euphorbia was the important part of his experience because he viewed Dr. Euphorbia as such an exceptional mentor. George expressed that this mentorship was a significant influence in his decision to be an UTA, and to ultimately pursue a PhD instead of medical school.

Heather

Heather was a 23-year-old female from the Midwest who had majored in Fisheries and Wildlife Biology. She worked as an UTA one time during her senior year (2015), with the investigator in General Biology II, the second semester introductory course for biology majors. This course was taught in the high-enrollment active-learning environment. At the time of the interview she was working as a wildlife technician. Heather expressed that wildlife biology is a very competitive arena, and that people-management, education, and communication are critical to success in that field. Heather stated that she did not participate in undergraduate research because she felt she would have opportunities to do that later during either employment or graduate school. She expressed viewing her time as an UTA as a way to gain experience, build her resume, and refine some of her fundamental knowledge before entering the job market. She was unsure if she wanted to attend graduate school, and if she did, she was unsure what area of natural resource management or conservation she wanted to specialize in. Working as a technician has allowed her to travel and gain a variety of experiences before settling on a more specialized career path.

Julia

Julia was a 25-year-old female who had double-majored in biology and science education during her undergraduate studies. Originally from the Midwest, she worked as an UTA twice, the first time during her senior year (2014), and the second during her self-described super-senior year (2015). She explicitly noted that completing the two degrees was a significant challenge because the course work did not align well. This poor alignment of courses required her to take an extra year to graduate. One of her experiences was in General Biology I lab, which is the lab associated with the first semester of introductory biology majors. She was responsible for a

section of approximately 30 students. The other experience was in General Biology II lecture, taught in the high-enrollment active-learning environment. This was the second semester course for biology majors. General Biology I lab was co-coordinated by a staff member and Dr. Euphorbia (pseudonym), and her experience in General Biology II was with Dr. Euphorbia. Julia also participated in undergraduate research as part of her undergraduate studies. Julia identified as wanting to be a high school science teacher and felt that working as an UTA would help her resume. She summarized her experience by saying that working as an UTA showed her all of the positive aspects of teaching and made her love it. However, after working as an UTA, she became disenfranchised with tasks such as lesson-plans, grading, and administrative burdens, during her student teaching. These experiences ultimately led her to return to school in the field of medical laboratory sciences. At the time of her interview, she was doing her year of clinical experience as part of that program and was much happier with her new career path.

Kevin

Kevin was a 23-year-old male who had been a biology major before being accepted to and subsequently attending medical school in the Midwest. Describing himself as born-and-raised in the same local area in the Midwest, at the time of his interview, he was in his second year of medical school. Kevin worked as an UTA three separate times during his junior (2014) and senior (2015) years. All were with Dr. Euphorbia, once in General Biology I lab, and twice in General Biology I lecture. General Biology I is the first semester Introductory Biology course for biology majors. In lab he was responsible for his own section of approximately 30 students. The lecture was taught in the high-enrollment active-learning environment. Kevin reported having experience as a tutor and having participated in undergraduate research during his undergraduate studies. His ambition was to attend medical school, and he reported that initially,

he viewed working as an UTA as a way to improve his resume and make himself a competitive applicant. However, he enjoyed the experience so much the first time that he continued trying to be an UTA every chance he had after that first experience because he found it so rewarding.

Lisa

Lisa was a 25-year-old female who had double majored in biology and science education during her undergraduate studies. Originally from the Midwest, she had worked as an UTA three separate times between 2014 and 2016. The first times was in General Biology I lab, which is the lab associated with the first semester introduction to biology course for biology majors. There, she was co-supervised by a staff member and Dr. Euphorbia (pseudonym), yet was responsible for approximately 30 students in her section. The other two times were during consecutive years in General Biology II, the second semester Introduction to Biology II course for biology majors, both times with Dr. Musculus. This course was taught in the high-enrollment active-learning environment. She worked as an UTA during her senior and self-described super-senior years, echoing Julia's sentiment that the double major was exceptionally challenging to complete because of course conflicts that resulted in extended time being required to complete her programs of study. Lisa did not tutor or participate in undergraduate research during her undergraduate studies. Her ultimate goal was to become a high school science teacher, and while she was not working at the time of the interview because of a recent move, she did have a high school science teaching job that would begin soon. She reported easily seeing herself return to school for more education, and subsequently teaching at either a community college or university. Lisa expressed wanting to get more teaching experience before she took on either of those aspirations.

Mabel

Mabel was a 25-year-old female from the Midwest who had gone on to pursue a master's degree in biology and avian studies after completing her biology degree as a Fisheries and Wildlife major. She was in her second year of that program at the time of the interview and reported already having been a co-instructor of a course at that institution, in addition to fulfilling her regular duties as a GTA. She credited the higher-than-normal level of responsibility with her extensive experience as an undergraduate, having worked as an UTA three times with the investigator. All were in Concepts of Biology, the introductory biology course for non-majors that would substitute for General Biology II, the second semester majors course, if taken prior to declaring a biology major. Mabel was an UTA during her junior (2014) and senior (2015) years. She also noted that she had conducted extensive undergraduate research, winning a national award for the presentation of her undergraduate research, and several state-level awards for related presentations during her undergraduate career. She was uncertain about her exact career aspirations, but confident that the natural resources and science education play prominent roles in that career. At the time of the interview she was considering a career as a wildlife refuge education coordinator or outreach specialist.

Noah

Noah was the oldest participant at 30 years of age, and the only participant to work as an UTA in lab only. Originally from the rural Midwest, Noah came to the university initially interested in aviation. Finances and a strong background with the outdoors and scouting combined to draw him into the Biology Department where he went on to complete his master's degree. He worked as an UTA before active-learning environments were constructed around campus, and before it was common practice to have UTAs present to help with active learning

during lecture sessions. He worked as an UTA one time in General Biology I lab supervised by Dr. Euphorbia in 2011. He reported also tutoring outside of class and completing work-studies assisting with research projects in a number of labs within the Biology Department. His stated goal with both was to help make himself a stronger candidate for graduate school within the department because he worked well with a number of the faculty. He expressed feeling that he was successful because he was admitted to, and subsequently completed his master's degree as he had hoped. At the time of the interview he had been working with an ecological observatory network coordinating nation-wide data collection in a supervisory and training role. Noah regularly traveled around the country with this organization to train others in how to correctly set-up, operate, maintain, and service equipment for coordinated ecological observation and data collection on a macro-scale.

Presentation of Findings: Codes, Categories, and Themes

The opening quote to Chapter IV by Kevin was used to illustrate the complexity, entanglement, and interwoven nature of many aspects of the UTA experience. Despite this however, a number of patterns consistently emerged from the interviews. By the end of data collection, no new codes or categories had emerged from the last three interviews, and no new relationships between categories were emergent. This lack of new codes led the investigator to believe that data saturation had indeed been achieved.

Four themes were identified describing the perceived long-term impacts of the UTA experience: Personal Impacts, Professional Impacts, Finances, and Concerns Not Supported. The following four sections will address each of these themes. A schematic diagram of the codes that contribute to each category, and the categories that contribute to each theme will be provided, along with assertions about the meaning and significance of these categories within

each respective figure. Illustrative quotes for each category will also be provided to substantiate the significance of each category within each theme. It is important to note that participants expressed an overwhelmingly positive perspective about their experiences. Coupled with the interwoven and complex nature of these categories, this finding led to more complex diagrams for Themes I and II than were initially proposed at the onset of this investigation.

Theme I: Personal Impacts

All participants perceived that the UTA experience resulted in significant personal impacts and agreed that these impacts were overwhelmingly positive. This result was confirmed by careful examination and comparison of the transcript and audio data. Appendices G1 through G13 contain a summary of the location and frequency of these codes in each transcript from the data for Theme 1. Figure 1 models how the codes and categories within Theme I relate, and summarizes the assertions related to these. Analysis ultimately resulted in 20 codes related to personal impacts, sorted and organized into five categories. These categories included Self-Confidence, Personal Reward, Sense of Community, Balance, and Self-Regulation as illustrated in Figure 1 below.

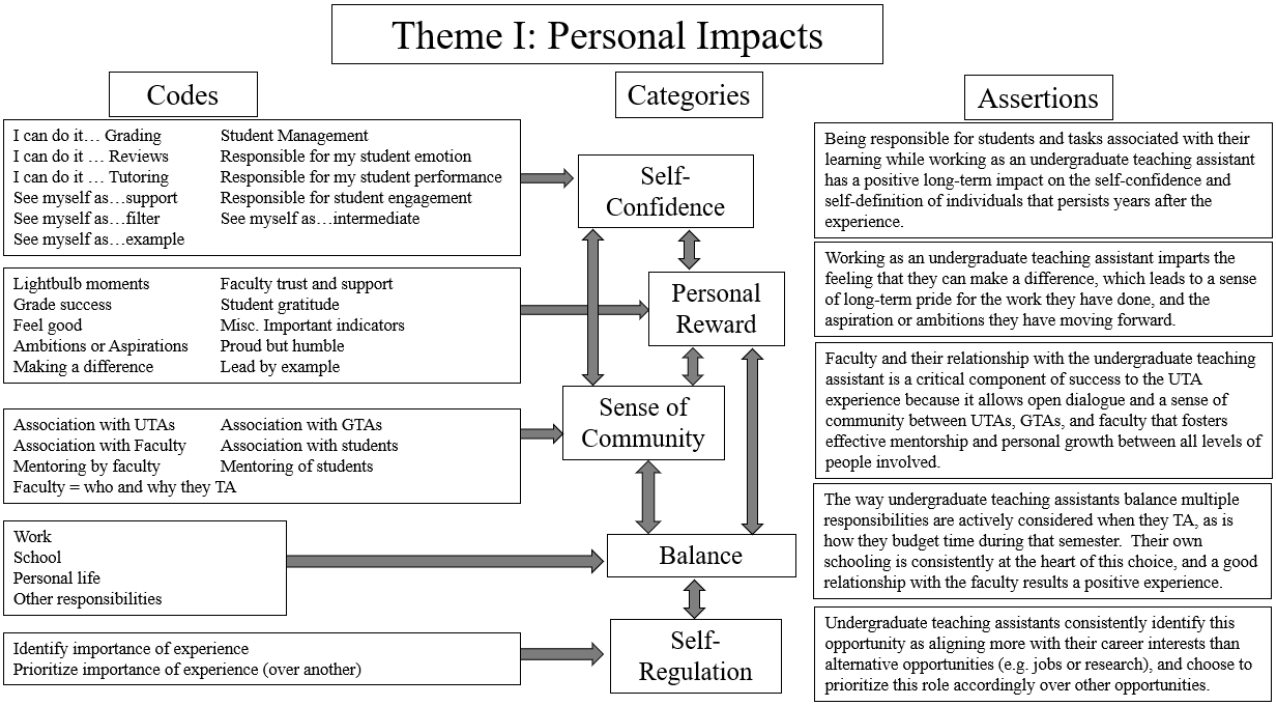

Figure 1: Codes, Categories, and Assertions of the Personal Impact Theme Related to the Undergraduate Teaching Assistant Experience

Category I: Self-Confidence

Participants in this study consistently discussed an increased sense of self-confidence as a result of their experiences as an UTA. An illustrative quote for the Self-Confidence category is below:

> Danielle: And in the beginning it felt like I had no idea what I was doing but (*chuckle*) I came around to it and I figured it out. But um – I hoped to gain more knowledge about introductory biology because that is really the foundation for the whole major, and if you don't know the foundation, you can't build on it. So like it *really* helped solidify my foundation of biology and I had hoped to gain that from it… Right off the bat I felt like I wasn't smart enough for it. To be honest. I was like "*Well, I'm just a sophomore, I took it, I got an A, but – at both the end of (General Biology I and II), I was like we'll see how it goes - hopefully"*. Hopefully I won't flop because I had no idea what I was doing…So like, this opportunity – how I started off not knowing what I was doing, as I started teaching more and more and helping the students learn, I was also learning.

The category of Self-Confidence was developed from codes illustrating a participant's expressed ability to accomplish some task or feat which they expressed intimidation with

initially, as illustrated above by Danielle. There were four independent codes related to this category that were specific to the UTA experience. Tasks such as grading, running reviews, tutoring students, being responsible for student emotions, performance and engagement, and effectively acting as an intermediate between students and the material they were engaged with, or the tasks they were to accomplish as part of their duties and responsibilities were examples of topics identified. These codes are listed above in Figure 1. A detailed description of each code is provided in Table 1 of Appendix C. These codes include topics such as student management, where UTAs dealt with handling students who were frustrated or had developed a negative attitude. Codes surrounding events where UTAs expressed how they viewed their abilities related to supporting students, helping them filter information, perform tasks or meet expectations were also categorized here. Examples of modeling behaviors and setting an example were included in this category as well.

Self-Confidence was by far the most complex and inter-twined category in this study. The consistent expression of such feelings as illustrated by Danielle's quote above, and the volume of their occurrence, led to the conclusion that being responsible for students and tasks associated with their learning made those who worked in the UTA role perceive a sense of positive long-term impact related to their self-confidence. That sense of self-confidence consistently persisted for years after the experience. One of the most common codes to arise from the entire analysis was the "I can do it…" code in the Self-Confidence category, with more than 210 independent examples of such codes across the 13 interviews by participants. This information is summarized in Appendices G1 through G 13. Danielle's quote above is illustrative of such feelings and perceptions, and examples like this could be found in almost every interview by every participant.

Another illustrative quote from this category of Self-Confidence is below.

> Mabel: When I was a student I, and taking biology classes, I didn't really have very much self confidence that I knew the material. Like, I could get good grades, and I could do all my assignments, but I think in the back of my mind I was still convinced that I wasn't really a science person. Cause I didn't like science, when I was in middle school or high school, I had bad science teachers, I had bad experiences with science. So in the back of my mind I still didn't think of myself as a scientist. But once I started teaching, and I realized that I knew these concepts well, and I could teach other people how to do it, it really solidified my self-confidence about biology and I kind of had a new appreciation for my own skill set. So I knew that I knew what I was teaching. and I didn't really get that from taking the courses. I got it more so from teaching them.

In addition to coding portions of this quote as "I can do it…", portions of the statement were also coded as "See myself as…" because Mabel's statement is characteristic of many such quotes that illustrate an aspect of self-definition that are the result of their experience as an UTA. Consideration was given to making such codes and their subsequent quotes an independent category, but this was ultimately rejected because self-confidence was a key driver of such self-definition. In the majority of cases throughout all interviews, codes of "I can do it…" were directly associated with "See myself as…" codes. In other words, there would not have been the same level of self-definition without the self-confidence, or UTA's seeing themselves as able to do what they were describing. Subsequently, the self-definition was a direct result of the UTA experience that allowed participants to accomplish things and see themselves as capable, competent peer instructors who were an integral part of the learning community. It is noteworthy however that the "See myself as…" code was the second most common code in the entire Personal Impacts theme, with more than 140 examples across the 13 interviews, as shown in Appendices G1 through G13.

The "I can do it…" and "See myself as…" codes were determined to be the axial codes within the category of Self-Confidence because of the interplay they had with each other, as

illustrated by Mabel's quote above, and because of their frequency and consistent correlation across interviews. Of the 11 codes within the Self-Confidence category, these two were by far the most important based on the consistent impact described by participants and the emotional tenor of their voices on the audio recordings as they described situations or scenarios that were coded this way. Essentially, the UTA experience built self-confidence that made these individuals more comfortable with how they saw themselves. The interplay of these two axial codes subsequently then led UTAs to be confident and comfortable enough in their roles, with their knowledge, and in their ability to handle a variety of scenarios or tasks that assisted student learning. For example, having a sense of accomplishment and confidence in themselves led to UTAs carrying out activities such as tutoring, running reviews, and in some cases assisting with grading. As they became comfortable in their roles and confident in their knowledge and abilities, UTAs viewed themselves as intermediates between the course content and the faculty and their students. This confidence in turn consistently led to other codes within this category related to supporting students, setting an example for those students, and filtering information for the students that were being assisted by the UTAs.

One example of this confidence was again from Danielle who articulated this by stating:

> I gave my contact information to all of the students, gave them my email – if they ever needed to contact me. I would tutor them outside of class. And then to try to help figure out how to set up a review session – they helped me figure out all of that so they were very helpful.

When questioned further, Danielle went on to say:

> I gave review sessions in (a large lecture-style room). Um…I would give a review session on Sunday before an exam, if it was on a Tuesday – just a few days before the test. And I don't know how it happened, but all of a sudden like the whole lecture bowl was full, and people were sitting there and I was like "*okay, well…*" (surprised and happy). It got to the point where it was like half the lecture bowl and it just kept building, and more students just kept coming to my – to my review sessions. *And it made me feel really good about myself* - that they

> actually understood what I was saying. And I sat there, if it was for 1 hour to 2 hours, I would stay there and be like "*Does anyone have any more questions – what can I tell you?"* I would go through the study guide with them and tell them that "*this is what I think is important*". Its – and like – draw diagrams, especially when we were getting into chemiosmosis and like dealing with the electron transport chain. I was like "*This is – let me draw everything out for you – and I highly suggest you draw it*". Um… it just, it felt really good to me that they thought that I was a good enough teacher in a way to help them understand their review sessions. A student actually came up to me and told me that "*Your review sessions helped me every time on the test. I don't know how I would do as well on these tests without your review sessions*".

At the same time, having the confidence to see themselves in such a role led UTAs to feel responsible for their student's emotions, which they found directly related to both student engagement and performance.

Mabel illustrated this responsibility by stating:

> I distinctly remember one student who was really frustrated because she wasn't understanding a concept, and I was trying my very hardest to get her to understand it, and I was teaching in all the different ways that I could, but sometimes they just put up this mental block where they can't listen to you anymore. Like, you can be teaching it but they're just so frustrated with them not understanding it or they think that they're doing something wrong where they can't understand the concept that they kind of shut down, and I distinctly remember it happening with this one student and she was getting so frustrated that she couldn't understand it… And then, at the end of the class period she came up to me and she was like: Hey, I'm sorry if I snapped at you, it wasn't your fault, you were doing a great job teaching me, I was just having a bad day and I appreciate all of your help. And so, that actually meant a lot to me because I knew that she wasn't mad at me, I knew that she was just frustrated and that she wasn't understanding it. But the fact that she came up to me afterwards and apologized kind of made me feel a little better.

George echoed this sense of responsibility, stating:

> I wanted to give the students in the class everything I could offer, you know, my time, anything I knew, help them get the resources that they needed to answer the questions they had. Umm, but I felt a responsibility like come test day or something, you know, I knew what that felt like, going into a big test that was worth a third of your grade or something like that. But I tried to do other little things like I prepared a couple biology jokes, stuff like that for that day to try and lighten their mood.

Danielle supported this further, also demonstrating her confidence by showing that she was comfortable enough to recognize when she needed help guiding students, and act accordingly by stating:

> I noticed that when I was a TA – I didn't want to give them – to give the students – wrong advice. Or to like lead them to like the wrong answer either, so I'd make sure to ask him if it was something I was confused on, even at that point.

Across all interviews, sentiments such as these were consistently expressed, with the codes for "I can do it…" and "See myself as…" regularly occurring together and in direct relation to each other. Additionally, they were frequently followed by the other codes sorted to the Self-Confidence category relating to UTAs feeling a sense of responsibility for their students and working as an intermediate in some capacity to help facilitate student success. Such regular patterns within and across participant interviews led to the assertion that being responsible for students and tasks associated with their learning has a positive long-term impact on the self-confidence and self-definition of UTAs. Furthermore, that positive perception persists years after the experience. The figure below is an illustration of the relationship between the axial codes of "I can do it…" and "See myself as…" with the other codes in the Self-Confidence category as described above and supported with illustrative quotes.

Figure 2 contains an illustration of the highly networked nature of this category. The Ying and the Yang shape featured prominently below was selected to represent the dynamic and intertwined nature of the most prominent axial codes "I can do it…" and "See myself as…". Participants sense of being able to accomplish things they previously doubted was consistently and directly related to how they expressed viewing themselves. Their sense of confidence in being able to accomplish tasks led directly to them taking on more tasks such as running reviews, tutoring, and in some cases, grading. Seeing themselves in a new light led them to feel that they

could effectively intermediate between the students, tasks in the class, and the material. The interplay of the two axial codes resulted in a sense of responsibility for the students they worked with and was exceptionally difficult to diagram. However, the network below was developed in part because this category was the most dynamic and complex, and it networked to several other categories within the Personal Impact theme as shown in Figure 1.

Figure 2: Category I Theme I – Codes Related to the Category Self-Confidence

It is also worth noting the link between Self-Confidence and the category Sense of Community, which is illustrated by the arrow between these two categories in Figure 2. The support of the faculty, graduate teaching assistants, and where applicable, other UTAs, all played a role in participants feeling confident enough to assist students, and comfortable enough to ask for help when they needed it.

Category II: Personal Reward

The Personal Reward category was developed from examples within the interviews where participants expressed personal gratification about some specific aspect of the UTA experience. A quote illustrating the Personal-Reward theme related to the Self-Confidence category as illustrated in Figure 1 is below:

> Danielle: I gave review sessions …I would give a review session on Sunday before an exam, if it was on a Tuesday – just a few days before the test. And I don't know how it happened, but all of a sudden like the whole lecture bowl was full, and people were sitting there and I was like "*okay, well*…" (surprised and happy). It got to the point where it was like half the lecture bowl and it just kept building, and more students just kept coming to my – to my review sessions. *And it made me feel really good about myself* - that they actually understood what I was saying. And I sat there, if it was for 1 hour to 2 hours, I would stay there and be like "*Does anyone have any more questions – what can I tell you?"* I would go through the study guide with them and tell them that "*this is what I think is important*". Its – and like – draw diagrams, especially when we were getting into chemiosmosis and like dealing with the electron transport chain. I was like "*This is – let me draw everything out for you – and I highly suggest you draw it*". Um… it just, it felt really good to me that they thought that I was a good enough teacher in a way to help them understand their review sessions. A student actually came up to me and told me that "*Your review sessions helped me every time on the test. I don't know how I would do as well on these tests without your review sessions*".

This quote was re-used because not only did it illustrate the personal reward expressed by many of these participants, but it also illustrated the interplay between the sense of personal reward with the category of Self-Confidence. The Personal Reward category was developed from examples within the interviews where participants expressed personal gratification about some specific aspect of the UTA experience. The category of Personal Reward contained six codes as illustrated in Figure 1, and most of these revolved around participants describing "light bulb" moments by the students they helped, feeling good about aspects of the UTA experience such as getting to interact with faculty and students, how the experience aligned with their ambitions or aspirations, and how it made themselves feel proud of what they were doing. Full descriptions of these codes can be found in Table 1 of Appendix C.

Faith illustrated the reward she felt from seeing students "get it" which became representative of the "light bulb" code by responding to a question about what really stood out to her about the UTA experience by saying the following:

> So, watching Jennifer and Lauren (pseudonyms) and all other students, but those specifically I worked with outside of class, umm, just watching them succeed…you get those students who like get it, and have that light bulb and are, like, "*wait, does that relate to*…" or they take it one step further. That was just kind of a nice, like, moment.

Kevin expressed similar sentiments in his response to the question by stating:

> (Helping students) it makes me…it makes you feel good about yourself, whenever you see the sparkle in someone's eye of like "*oh, I get it now"*… but like, I didn't view myself high because I was a TA and helping kids or anything… it just made myself feel good, and I viewed myself better for having helped others.

Quotes such as these, especially when the audio is examined, make three points very clear. First, UTAs consistently find tremendous reward and satisfaction in helping the students they work with. Second, they are consistently humble about being able to use their abilities to assist others in this manner. This humility is less obvious in the direct texts of a transcript, but voice inflection and tone consistently imply that they are aware of their own intellectual abilities, but did not want to brag about it, and were almost sheepish to admit or acknowledge that their abilities were so exceptional. Finally, there is a sense of pride that goes along with such experiences that is almost always evident. These UTAs are proud, yet humble, about how well they were able to help their junior peers accomplish any number of things from graded tasks to developing big-picture conceptual ideas.

Kevin went on to say this about the experience of helping students as an UTA shortly after the quote above, saying:

> I am really glad I TA'd – that's definitely a reflection I have when I look back at my undergrad.

Descriptions of helping students varied across all participants, but this variation was largely a function of the course that individual UTAs worked in. Those who worked as an UTA several times and in different courses consistently described feeling personally rewarded about

situations or scenarios that helped students earn higher grades and make connections between content-related ideas regardless of the course. Those who served as an UTA a single time, or multiple times in the same course similarly all described feeling good about how well their students could and would do as a result of their help and expressed a sense of proud humility in being able to help their fellow students. It was clear this made them feel good about themselves, and what they were doing.

Noah articulated this by stating:

> I don't want to really get into actions with the students themselves. I guess, …it's difficult to come up with a particular one… I guess there were several students I had in that lab where I just had really good interactions with them and a lot of them, they would stay late and stuff and try to really get the material. And, I mean, they weren't by any means rock star stellar students, … stellar students in the classroom, in the lecture or anything. But, you know, I felt I was able to provide them with, you know, that kind of individualized attention that they needed.

Emily may have summarized the sense of reward based on the experience even better, when she said:

> I honestly wish I could have done it again. I wish, and I even told you that, I wish that my schedule would have allowed me to do it again. Because I loved it. And if this doctor thing doesn't work out, this is probably, I am probably going to go into being a professor.

Quotes such as those by Danielle, Kevin, Faith, Noah and Emily serve to illustrate two things that are critical here. First, within the category of Personal Reward they illustrate that the codes "Making a difference," "Feel good," and "Proud but humble" were the axial codes; those important codes that others seem to hinge upon or revolve around because they are the most significant. Across all 13 interviews, there were more than 80 examples of statements coded as "Feel good", more than 100 coded as "Proud but humble", and more than 60 coded as "Making a

difference". The relationship between these three axial codes and the other codes within the Personal Reward category is illustrated below in Figure 3.

Second, in addition to serving as illustrative support for the sense of humble pride and feeling good about making a difference, quotes like Danielle's and Noah's in particular also illustrate the connection between the categories of Personal Reward and Self Confidence. These UTAs ultimately develop a sense of security in their own ability to assist students, the courage to make such attempts, and subsequently feel good about the outcomes of those efforts; they believe they can and did make a positive difference for their students, and they felt good about that. This reinforces their self-confidence as illustrated by the arrow between Personal Reward and Self-Confidence in Figure 1. Ultimately, this led to the assertion that working as an UTA imparts the feeling that these individuals can make a difference for the students they work with, which leads to a sense of long-term pride for the work they have done and the ability to attain the aspirations or ambitions they have moving forward. Additionally, such quotes also illustrate the importance of the next category to be addressed, Sense of Community. The illustration between Personal Reward and Sense of Community is illustrated by the arrow between these categories in Figure 1 above.

Figure 3 below illustrates the relationship between the various codes, with the axial codes making up the three tips of the pyramid. This shape was selected to illustrate this category visually because it allowed all three axial codes to be on the exterior. The significance of this is that these codes would be what connect to aspects of the experience outside of this category, which is appropriate for the highly networked nature of this theme shown in Figure 1.

Additionally, as structured and organized, it allowed all other codes to be central to the axial codes, which was appropriate because of the interconnected nature of codes within this category.

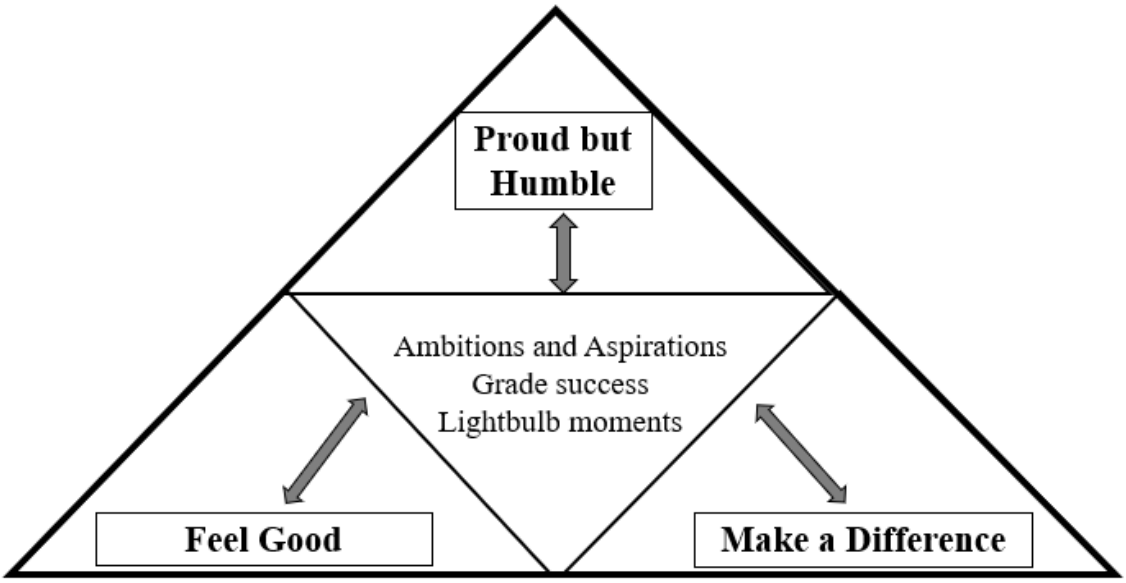

Figure 3: Category II Theme I – Codes Related to the Personal Reward Category

It is worth noting that the category of Personal Reward was significantly networked to other categories including Self-Confidence, Sense of Community, and Balance. A number of the quotes above illustrate this interconnectedness because they illustrate how UTAs like Faith, Kevin, Noah, and Emily all gained confidence in themselves as a result of helping students. This relation is illustrated by the arrow in Figure 1 linking Personal Reward to Self-confidence. Likewise, the category Sense of Community, discussed below, was important because ultimately, faculty fostered an environment that mentored these participants through the experience in a positive manner. This relationship is illustrated by the arrow linking Personal Reward to Sense of Community in Figure 3 above. Similarly, Personal-Reward was perceived as a result of successfully balancing the responsibilities of working as an UTA while managing other

obligations. This is illustrated by the link between Personal Reward and Balance in Figure 1. The categories Sense of Community and Balance are developed below.

Category III: Sense of Community

Personal relationships that developed as the result of these experiences persisted between UTAs and their students, between UTAs and GTAs, and between UTAs and faculty. All of these increased a sense of community in participants. Illustrative quotes for the Sense of Community category are below:

Noah articulated the sense of community between UTAs and students as addressed above by stating:

> I don't want to really get into actions with the students themselves. I guess, …it's difficult to come up with a particular one… I guess there were several students I had in that lab where I just had really good interactions with them and a lot of them, they would stay late and stuff and try to really get the material. And, I mean, they weren't by any means rock star stellar students, … stellar students in the classroom, in the lecture or anything. But, you know, I felt I was able to provide them with, you know, that kind of individualized attention that they needed.

Noah went on to also articulate the sense of community between undergraduate and graduate teaching assistants, stating:

> …luckily there were some, some other graduate students that were also teaching that. Jimmy, he was also teaching that and James (pseudonyms). They were also teaching (General Biology I), at the same time and they helped me out a lot. Umm, they kind of showed up to my first one just to make sure I had everything taken care of and whether that was instructions from Euphorbia or not, I don't know. But, yeah, whenever I had questions and stuff, I would go ask them.

George articulated the sense of community between UTAs and faculty by stating:

> So, my very first biology class at (this university) was with Dr. Euphorbia, and, umm, I immediately felt I connected with him. Umm, I enjoyed his course so much I thought the, the passion for teaching and the knowledge of the subject matter that he brought to the course was beyond anything I've experienced and I appreciated it so much that I, I came to (this university) just doing a Bachelor of Science in chemistry and then I added biology as a major after taking that General

> Biology I, and added him as an advisor… so I think being a TA for him, the *for him part*, was the most impactful part. He provided any type of support I needed, but the key was that he provided enough room to grow as a TA.

Quotes like these were selected to illustrate the importance that a sense of community played in the UTA experience. The category Community included codes assigned to any description that illustrated or exemplified the expressed or implied reliance of one party on another, or the importance of the UTA being associated with another party. These included the reliance of students upon the UTAs as illustrated by Noah's first quote, the reliance of UTAs on GTAs as illustrated by Noah's second quote, or the reliance of UTAs on faculty as illustrated by George's quote. There were often examples of mentorship within these relationships, such as Noah when, as an UTA, articulated how the GTAs Jimmy and James (pseudonyms) watched out for him. Likewise, George's quote illustrates that his association with his faculty mentor was important to him because of his admiration and respect for that particular faculty member. This was the direct result of his own personal experience as a student in that faculty member's class which resulted in a desire to associate and model himself after that exceptional faculty member. The desire for this association and modeling was a significant contributor to making his experience as an UTA so valuable because the faculty provided both support and room to grow.

Ultimately the category Sense of Community contained four codes as shown in Figure 1. Unlike the categories of Self-Confidence and Personal Reward, there was ultimately only a single axial code in the category Sense of Community. This code was "Faculty are the primary motivator of community". Interestingly, this code was not the most common code within the category of Community as shown in Appendices G1 through G13. However, it consistently appeared to be the most important. This is evident when examining larger blocks of the transcripts because a single example of the faculty member being the reason an individual

pursued working as an UTA was often followed with multiple examples of subsequent associations with other UTAs, with GTAs, and examples of mentoring between these parties. Ultimately, faculty and their relationship with the UTA was a critical component of success to the UTA experience because it allowed open dialogue and a sense of trust between UTAs, GTAs, faculty, and students. This trust fostered effective mentorship, making all parties open to the others, and allowing personal growth by the UTAs because of a desire to associate with GTAs and faculty, whom they looked up to, admired, and wanted to model themselves after. This desire by the UTAs to model themselves after the GTAs and the faculty often contributed to their desire to do the best they can for the students they are working to serve. This is illustrated by quotes such as the one already provided by George above, which is presented here to illustrate the connecting arrow in Figure 1 between the categories of Self-Confidence and Community. George stated:

> I wanted to give the students in the class everything I could offer, you know, my time, anything I knew, help them get the resources that they needed to answer the questions they had. Umm, but I felt a responsibility like come test day or something, you know, I knew what that felt like, going into a big test that was worth a third of your grade or something like that. But I tried to do other little things like I prepared a couple biology jokes, stuff like that for that day to try and lighten their mood.

This quote was selected because George described above how the faculty member was the important part of his experience, and that translated here to George wanting to do the best he could for his students and empathizing with them on exam days that were likely very stressful.

Further support for the importance of the faculty member in developing a sense of community with the UTAs was presented by Emily (who worked with the interviewer one semester), when she stated:

> I probably would have done it (UTA) without pay because I really wanted the experience. That came and then also the experience of getting to know a faculty

> member, because I didn't really have that yet. I knew that I needed to get in with somebody that could help me because my advisor didn't always help me with everything that I needed…, I saw the value in having a professor in my corner. That was really something that I needed.

Faith (who worked as an UTA with the interviewer three semesters as an undergraduate) further supported the importance of a good relationship with the faculty being a driving force in why she chose to be an UTA by saying:

> I wouldn't be in biology if it wasn't for you, if I didn't TA I probably would have not ever loved it as much as I did love it because I'd really gotten exposed to it, from a different angle, so it definitely helped.

Finally, Lisa stated:

> I was working with a great team, so I was always looking forward to going back. There was never a day where I just really did not want to be there. So yeah, definitely, when you work with a good team it makes it easier. Probably another positive experience was just my change of outlook. As far as when like, approaching instructors, or dealing with instructors. Because after that first Spring semester when I TA'd in lecture, that following fall I had Diane – I had her developmental biology class, and so, working with her, I got to know her as an instructor.

Quotes such as these were selected to illustrate the importance of the relationship between the faculty and the TA. It is noteworthy that nearly all participants here articulated what an exceptionally positive opportunity their UTA experience offered, largely because they selected faculty and classes that they wanted to work with or in, as articulated by both Emily and Faith above. At the core of almost all such examples from within the data was an explicit or implicit reference to how important the faculty member was in creating this sense of community between themselves, TAs at both the graduate and undergraduate level, and the students.

Interestingly, eight of the 13 participants here explicitly mentioned at one point or another in their interview asking the faculty with whom they worked as an UTA to serve as a reference or provide a letter of recommendation after the experience. Three made no mention of

it either way, and two (Noah and Cassandra) stated that they had not. However, Noah stated that in his case this was because he had participated in undergraduate research or work study in some form for three and a half of his four and a half years and, as a result, felt he had other faculty who knew him better and could provide stronger letters than the faculty with whom he worked as an UTA only during that single semester in a lab where he was fairly independent. Cassandra provided no explanation for not asking for a letter of recommendation.

Figure 4 below diagrams the relationship between the axial code related to faculty being a primary motivator of Community with the other codes in that category. A pyramid diagram was selected to represent the relationship here because of the stable nature if this shape. Faculty were consistently key to the balance and stability of all aspects in this category, directly impacting all other codes. Without their strong guidance, everything else here would collapse.

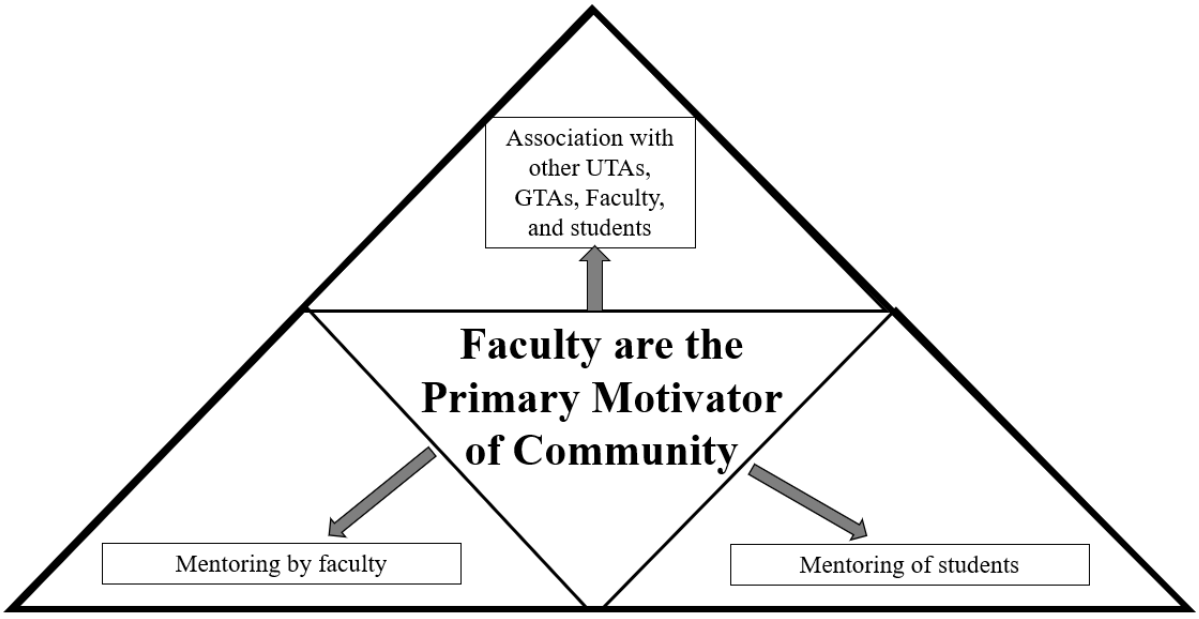

Figure 4: Category III Theme I – Codes Related to the Community Category

Category IV: Balance

Participants consistently recalled actively considering course workloads as they selected when they wanted to work as an UTA, realizing that they would have to balance these responsibilities. A relatively simple and straight forward quote illustrating how these students balanced choosing when to work as an UTA came from Heather, who stated:

> Yeah, I think if I had the same amount of credits I was taking in the spring I don't think that (being an UTA) would have happened… I think I was taking 15 credits or 16. But my spring semester I ended up taking 21 credits, which was a nightmare.

This quote illustrates the straight forward yet intentional reasoning expressed by many of these participants in selecting when they chose to work as UTAs. Time management and balancing the commitments of school with work, personal lives, and other commitments such as Greek Life, professional organizations, or hobbies were consistently expressed. Likewise, there was a consistent emphasis placed on prioritizing their own schooling. However, the category Balance was closely associated with the categories of Personal Reward and Sense of Community as well as illustrated in Figure 1 above.

Two quotes representative of the relationship between the category Balance with Personal Reward and Sense of Community are below. The first is from the participant Emily, who worked as an UTA her junior year with the investigator. Emily wanted to be an UTA again because of the personal reward she felt as described below but was never able to do that because she felt the need to prioritize her own schooling and studying for her MCAT. In addition to being illustrative of the category Balance, this quote was selected because it is highly expressive of the interplay the category Balance played with the category Personal Reward as illustrated in Figure 1 above by the arrow between these two categories. This was a regular pattern in the interviews, and Emily exemplified the relationship quite articulately by stating:

> I think at the end of it, at the end of being a TA, when it was over, I was like, "*wow, I'm really glad that I did that. It was really fun, I learned a lot, and I met really great people"*, and, since then, I've always told you, I wanted to do it again, and it just unfortunately had never worked out. I got really busy in my super senior year - I was really busy with MCAT and I think, the fall semester I took 18 credits I think, and then in the spring semester I took 16 but I also took my MCAT. So, I was very busy that year. And unfortunately, it (working as a TA again) just didn't work.

The second illustrative quote is from Adam, who also was an UTA with the investigator, but during the last semester of his senior year. Adam's ultimate goal was to become a professor. He was an UTA at the end of his senior year after being accepted into a master's degree which he was in the last year of at the time of his interview. Below he describes how he selected when to try working as an UTA and who he wanted to do that with, along with the role that balancing his own studies played in the timing of that decision. Like Emily's quote above, this was highly representative of many participants who wanted this experience because they saw value in it, but were judicious in their selection of classes, faculty, and timing to ensure they were not overloaded, that they got the most for themselves out of the experience and offered the best resource to the students and faculty they worked with. Adam articulates this quite well stating:

> The main reason (I worked as an UTA) is that I knew you were the instructor. (General Biology II) is the second semester intro to the major's course, and the main reason I picked it, I knew you… So I knew how you operated, I knew you were gonna be organized, and have everything ready. So I wasn't concerned from that point, which is appealing as a person wanting to work in a class room. So that was one reason. Another reason was that… I guess Ecology would have been the other class that I might have wanted to be a UTA for. But that's in the fall, and (General Biology II) is in the spring, that's just how the schedule worked out. Yeah…It (working as an UTA) was my very last semester, which I by design made it the lightest semester I was gonna take as an undergrad. So I really didn't have that many classes, as far as I was taking – which may have actually helped me UTA because I was able to invest more time in that as a result. I probably wouldn't be an undergrad teaching assistant if I had a busy one. There are a couple semesters where I can tell you I wouldn't want to be an undergrad teaching assistant because I just wouldn't have had the time to do it… I think there is definitely some semesters where I wouldn't do it, but for the most part, yeah, it's doable.

This quote by Adam was also selected because it echoes the feelings of Heather about balance, and it was highly representative of the relationship that continually arose between the category Community and Balance. As discussed above in the section on Community, trust and communication with faculty were viewed as critical by these UTAs because they enabled and supported positive interactions between UTAs, GTAs, faculty, and students. Adam and Emily both articulate this in their selected quotes above. These interactions subsequently facilitated mentorship and the sense of community for which that category was named. Many of these participants imply that they had not yet developed the sense of self-confidence that they possessed upon completing their UTA experience, which is why there is no arrow to the Self-Confidence category in Figure 1. In discussion about how and when participants selected to work as UTAs, the faculty was consistently central to that decision, and the participants own studies were consistently central to that decision. The faculty is key because, like Adam implies in his quote above, when these individuals decided to try working as an UTA, they still were unsure of themselves and their ability to manage the complex requirements this would entail. But they were aware that it would be challenging and relied on a faculty whom they knew and trusted to help mentor them through the experience and get the most possible from it. Heather, Emily, and Adam all express that busy semesters with high levels of course work were not ones that they wanted to TA in because they recognized that balancing their own school work with those commitments would be unlikely to promote a positive or rewarding experience.

Participants here consistently expressed such feelings. These UTAs balanced multiple responsibilities such as work, school, personal lives, and other miscellaneous responsibilities such as extracurricular activities, hobbies, or getting sick during the semester. Responsibilities such as work, their own class schedule, and personal interests were actively considered in

selecting when they TA, who they TA with, and budgeting of time accordingly during the UTA experience. Their own schooling was consistently at the heart of these decisions. A good relationship with the faculty, selecting appropriate semesters to TA in, and courses that students had experience with and interests in, coupled with appropriate management of time consistently resulted in a positive experience by these participants. Because balancing their own schooling was consistently expressed as the priority, and schooling was consistently expressed as balanced against the other codes of work, personal life, and other responsibilities, the code School was determined to be the axial code on this category as displayed below in Figure 5. Additionally, it was the most common code in this category, appearing almost 40 times in the interview transcripts, followed closely by the code "Work", which appeared just over 30 times as shown in Appendices G1 through G13. A pyramid diagram was selected to illustrate this category because of the stability and balance the shape represents, and because the repeating smaller triangles that make up such a shape illustrate the equal and stable relationship between these codes that were expressed by these participants.

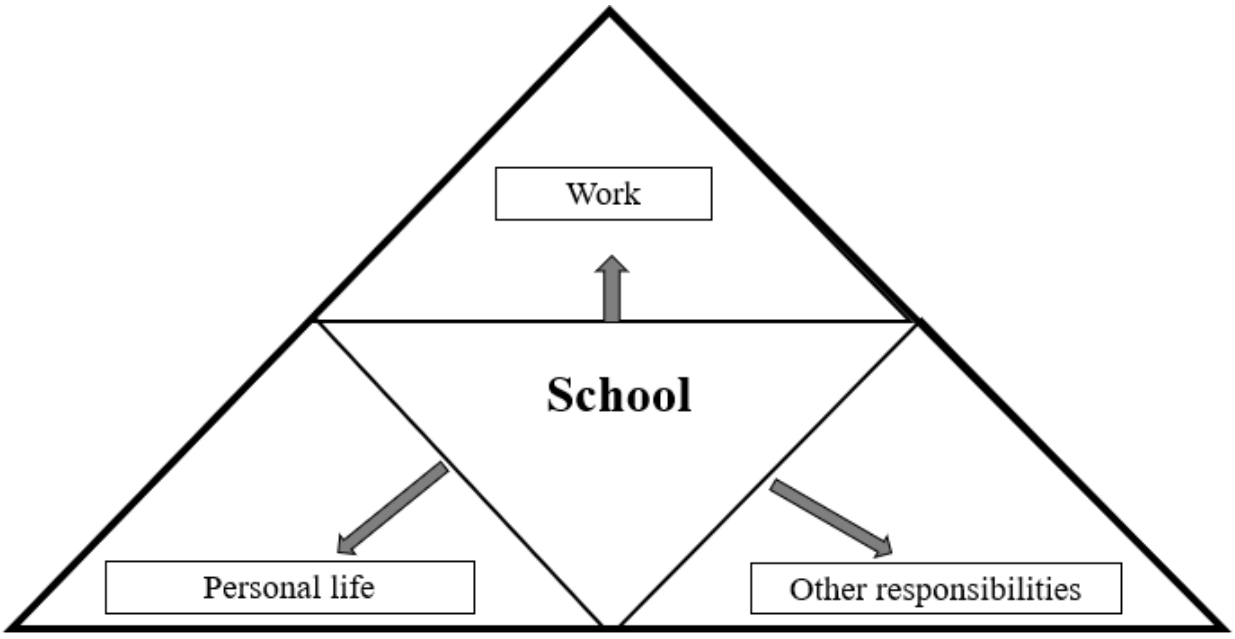

Figure 5: Category IV Theme I – Codes Related to the Balance Category

It is worth noting that the category "Balance" was closely related to the next category "Self-Regulation" as illustrated by the arrow between these two categories in Figure 1. They were ultimately separated into two categories because codes assigned to the Balance category consistently focused on *how* UTAs accomplished budgeting their time. Codes assigned to the category Self-Regulation focused on *why* UTAs identified and prioritized their choices in making these decisions. Further descriptions of these codes can be found in Table 1 of Appendix C.

Category V: Self-Regulation

Participants here consistently discussed identifying the importance of this experience, and then actively working to regulate their other commitments in a fashion that allowed them to devote adequate time and effort to that decision. An illustrative quote for the Self-Regulation category came from Brian who stated:

> I guess the main thing for me was scheduling. Having – like I definitely didn't take certain classes just so that I could TA – elective classes. I was totally fine with that. I was lucky enough to come in to my freshman year with 30 – 35 or so credits. So I had a lot of flexibility with my schedule.

This quote was selected as the illustrative representation for this category for two reasons. First, the category of Self-Regulation contained only two codes that focused on why participants identified and then prioritized working as an UTA over an alternative experience. Those codes included "Identify importance of experience" and "Prioritize importance of experience" (over another). Brian's quote illustrates both in a succinct manner because he first identifies that working as an UTA and taking elective courses within his major both had value to him, and he then prioritized being an UTA over the electives because his schedule and transfer credits allowed it, and he valued the UTA experience more than the electives.

The second reason this quote was selected is because it also demonstrates the close correlation between the category Balance and the category Self-Regulation. How and why UTAs pursued this opportunity, and subsequently budgeted their time and effort were consistently very closely linked by all participants. This relationship is depicted by the arrow in Figure 1 between these two categories. Participants here consistently identify this opportunity as aligning more with their career interests than alternative opportunities such as jobs or research and choose to prioritize this role accordingly over other opportunities. These choices then subsequently influence the "Balance" category because once that decision was made, it required individuals to budget time accordingly as they worked in the role of an UTA. The arrow was kept as two-directional because eight of the 13 participants chose to work as UTAs multiple times, and two of the others who only served as an UTA once explicitly stated that they wished they had been able to UTA more. This is illustrated below by the quote re-used from Emily who stated:

> I honestly, wish I could have done it again. I wish, and I even told you that, I wish that my schedule would have allowed me to do it again. Because I loved it. And if this doctor thing doesn't work out, this is probably, I am probably going to go into being a professor.

Figure 6 below shows the relationship between the two codes for the category of Self-Regulation. A balance-beam or scale with "identifying" and "prioritizing" formed the fulcrum or pivot point in the figure illustrating why participants here decided to pursue working as an UTA over other opportunities such as taking elective courses, "easy" semesters with decreased obligations, working off campus, or other activities such as undergraduate research. This was appropriate because it represented how these individuals weighed the choices or options they were presented with and selected opportunities based on perceived values.

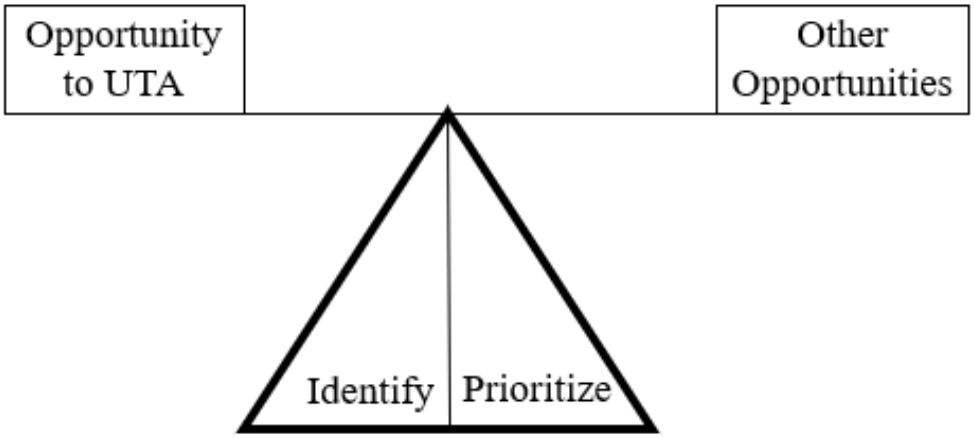

Figure 6: Category V Theme I – Codes Related to the Self-Regulation Category

The final quote selected to conclude discussion of the theme Personal Impact comes from Danielle who stated:

> I felt really good after TAing. It felt like the students really understood it. It made me feel good, and it made me want to do it again and keep trying. So I enjoyed that good feeling - that I felt accomplished, and I felt like I knew what I was doing. Um, so…that impacted me because it reminded me that I should feel that good about my major and my field. Because at the time I felt like I was

> struggling with my major and I was like "*If I can feel this good about my major and feel this good about teaching students about biology then clearly I really like biology*", So I was like, "*This is the major for me*", and I kept going on with it and I still love it.

This quote was selected here to conclude this theme for three reasons. First, Danielle articulates some aspect of every category within the Personal Impact theme in this single statement. There are references to her gaining self-confidence as a result of this experience. The personal reward she felt features prominently throughout this entire quote. She implies a sense of community between her and the students she was helping. She also implies that this experience helped bring balance to her life by helping her see the value of the major she was pursuing at the time but articulates struggling with. Her decision to stick with it as a result of serving as an UTA, and subsequently still loving it, help support the important role this experience played in her life. This makes it reasonable to conclude that she is happy now with that decision. Finally, self-regulation is demonstrated because making that decision to stick with the major required her to identify biology as the major she wanted to pursue, and then allocating time, energy, and resources to achieving that goal over something else like another major. Second, the fact that all categories of this theme are illustrated here in a single quote demonstrates the highly networked nature of the categories within this theme. This networked relationship is illustrated by the arrows between themes in Figure 1. Personal Reward features prominently as the heart of this statement, and that category is central to the network of this theme's illustration in Figure 1. Finally, this chapter opened with a quote by Kevin referencing the complexity of these experiences, and the difficulty in teasing apart single facets of such an experience in an attempt to understand their impact. Danielle's statement above substantiates the highly complex nature of attempting to understand these perceptions but illustrates that the work here has developed a model which successfully aligns with the major features important to that

experience and delineates them into categories, built of codes which can be identified, isolated, and understood.

Discussion of Theme I: Personal Impacts with Relation to the Relevant Literature

Weidert et al. (2012) identified a gap in understanding the benefits of working as either a graduate or undergraduate teaching assistant. Wheeler et al. (2015) noted a similar gap in understanding related specifically to UTAs in the context of examining their experience in inquiry-based learning environments (Wheeler et al., 2015). However, the Wheeler et al. (2015) work provides one of the few references to a theoretical framework related to understanding the UTA experience by suggesting that Situated Learning Theory may inform the development and support of UTA training programs (Wheeler et al., 2015). It also provides insight into understanding the perceived long-term impacts of the UTA experience investigated here.

Lave and Wenger's early work on Situated Learning Theory later progressed to work focused on communities of practice (Lave & Wenger, 1991, 1998). Their work challenged the prevailing assumptions of the time that learning was an individual process with a beginning and an end that occurred in isolated segments independent from the rest of life, and as the direct result of teaching. Instead, they re-conceptualized learning as the result of experiences situated within an ongoing process of social engagement. According to Lave and Wenger's Situated Learning Theory, over time, learning comes to reflect both the pursuit and the social relations that a learner experiences in a way that ultimately helps them shape their own identity (Wenger, 1998). Situated Learning Theory is more than simply experiential learning because it involves full participation rather than peripheral exposure in order to generate meaning (Tennant, 1997, 2007). This is a process that results in novices developing and progressing through participation that is legitimized by context within a community (Lave & Wenger, 1991).

Coupled with ideas such as those of Vygotsky, Lave and Wenger's works have been highly influential on pedagogical practices within STEM disciplines in the development and promotion of active learning such as the environments that all participants here worked in (Bevan, Gutwill, Petrich, & Wilkinson, 2015). The focus of Situated Learning Theory on groups, networks, and associations align almost perfectly with the codes that were organized into the five categories of Self-Confidence, Personal Reward, Sense of Community, Balance, and Self-Regulation that composed Theme I: Personal Impact, and further supports the relationships illustrated in the model shown in Figure 1.

For example, as illustrated in Figure 1, Sense of Community was one of the central categories that was most highly networked to the other categories within Theme I. The word "community" was found to have multiple meanings within the primary literature, but the meaning conveyed here is that related to interest, where people share common characteristics other than place or location to establish interpersonal connections that lead to a group who share common interests and values (Hoggett, 1997).

Illustrative quotes included above within the category of Sense of Community such as those by Noah, George, Emily, Faith, and Lisa contributed to the conclusion that faculty were the most important determining factor in participants' sense of community. The importance of faculty and their influence on other codes within this category led to assigning this as the axial code as shown in Figure 4. However, it was clear based on those quotes that there was a sense of community between all members, including UTAs, GTAs, students, and faculty. Likewise, mentorship by the GTAs and the faculty fostered personal growth of the UTAs and allowed them to act as mentors to students within the classes they served, which legitimized their role. One way that these interactions were significant was because they led to the two other categories of

Self Confidence, Illustrated in Figure 2, and Personal Reward, illustrated as Figure 3, within Theme I as illustrated in Figure 1.

By being immersed in the full participation of the UTA experience where participants were dynamically engaged in supporting students within an active learning environment, or independently managing labs themselves, participants consistently expressed that their self-confidence was positively impacted, and that they developed a sense of personal reward for what they felt they accomplished during their UTA experience. Quotes in the Self-Confidence category by Danielle, Mabel, and George above were all provided as representative support of this development of self-confidence. They make it clear that developing a sense of being able to accomplish tasks like those coded as "I can do it…" and the impact such experience had on how they saw themselves, coded as "See myself as…" were the most important to these participants. This is why these codes became the axial codes as shown in Figure 2. Likewise, quotes by Danielle, Faith, Kevin, Noah, and Emily were provided above as evidence of the category Personal Reward. Feeling good about being able to make a difference, along with a sense of proud humility were central to this category, which is why those three codes were determined to be the axial codes as shown in Figure 5, and subsequently influencing, relating to, or being associated with the other codes in the Personal Reward category.

No primary literature was located that specifically tested theoretical models of either situated learning theory or communities of practice on the impact of self-confidence or anything resembling personal reward. However, a great number of works document the benefits of peer-leaders, near-peers, and peer-experts, all of whom have similar functions to UTAs. For example, a number of studies illustrate that undergraduate peers, like those listed previously, are effective at facilitating the learning of other undergraduates in a variety of STEM disciplines. Benefits

consistently found include reports that such peers improve the achievement, attitude, performance, self-concept, and self-confidence of those being supported, and that such benefits are also experienced by the peer leaders themselves (Bowling, Doyle, Taylor, & Antes, 2015; Chapin et al., 2014; Cherestes, 2015; Johnson, Robbins, & Loui, 2015; Pon-Barry, Packard, & St. John, 2017; Rahm & Moore, 2016; Wilson & Varma-Nelson, 2016). With this in mind, it does not seem unreasonable to conclude that UTAs would also experience such benefits. Such reasoning further supports the proposed structure of Figure 1 which models these benefits and their relationship to each other because it seems reasonable to conclude that they align with works examining similar situations with other peer leaders.

Balance and self-regulation as described here and illustrated in Figures 4, 8 and 9 were different from the other categories of Self-Confidence, Personal Reward, and Sense of Community within Theme I. Through the lens of Situated Learning Theory, these can be interpreted more as personal attributes or characteristics important for success that were identified by all participants. Initial analysis places them as categories within the Personal Impact theme as shown in Figure 1. No work was located in the primary literature specifically evaluating or testing these categories relevant to Situated Learning Theory or any other relevant learning theory in the STEM disciplines or related to teaching assistants. However, a number of works related to Teaching Assistants consistently document that time management and organization are key characteristics in successful TAs (Chan & Bauer, 2015; DeBeck & Demaree, 2012; DeBeck et al., 2010; Patitsas, 2012; Schalk et al., 2009; Spike & Finkelstein, 2010; Weidert et al., 2012). Likewise, when presented the opportunity, faculty select TAs based on previous experience with those individuals and are likely to consider their organization and time management, in addition to their personalities and academic abilities (Chapin et al., 2014).

It seems reasonable that effective time management and the ability to balance multiple responsibilities and practice self-regulation would be among those characteristics selected for. With this in mind, Figure 1 was determined to be accurate because it illustrates such a relationship. A significant reason for this is because the work here documents from the UTA perspective that they perceived themselves as possessing these characteristics, and developed them further, as a result of the UTA experience. Figure 5 identifies School as the axial code for this category because it was by far the priority around which all other responsibilities were balanced by these participants. Likewise, Figure 6 represents a scale, indicative of how these participants weighed their opportunities relative to their identified priorities. This would seem to be a meaningful contribution to the literature because it illustrates the decision-making process undertaken by students as they considered these options and could inform how and when future UTAs and faculty decide to engage in this experience. Quotes by Brian, Emily, and Danielle are provided within these sections to support this conclusion.

It is worth noting at this point that the discussion of primary literature related to Theme II: Professional Impacts, centered heavily on Self-Determination Theory. References supporting the discussion of that theme below make reference to balance and self-regulation, which would suggest a possible need to rearrange these codes and categories into that Theme. This was rejected in favor of keeping them both in Theme I: Personal Rewards, because all participants either explicitly or implicitly described codes in both categories related to themselves personally, far more than they did professionally. Likewise, text related to such codes was much more linked to other categories within the Personal Impact theme as shown in Figure 1. Because Grounded Theory provided the methodological approach for this investigation, and advocates making such decisions grounded or rooted in the data itself, the decision was made to keep these

codes and categories in Theme I because that seemed more appropriate to these participants, and Figures 4 and 10 illustrating Themes I and II were grounded in the data, not created to match the theoretical framework of others.

Theme II: Professional Impacts

Similar to the first theme Personal Impacts, all participants also perceived that the UTA experience provided the opportunity for significant professional growth and development. The opportunity for this professional growth was also perceived as overwhelmingly positive, just as the Personal Impacts were. This was confirmed by careful examination of both the transcript and audio data of all participants. Analysis ultimately resulted in 16 codes related to professional growth and opportunity, sorted and organized into four categories as illustrated below. These categories included Professional Development, Experience, Career Exploration, and Value Compared to Research. Unlike Theme 1 related to Personal Impacts which was a much more intertwined network, Theme 2 presented a centrally focused category of Professional Development that related to all other categories within this theme. These themes, their development, and relationships are discussed below.

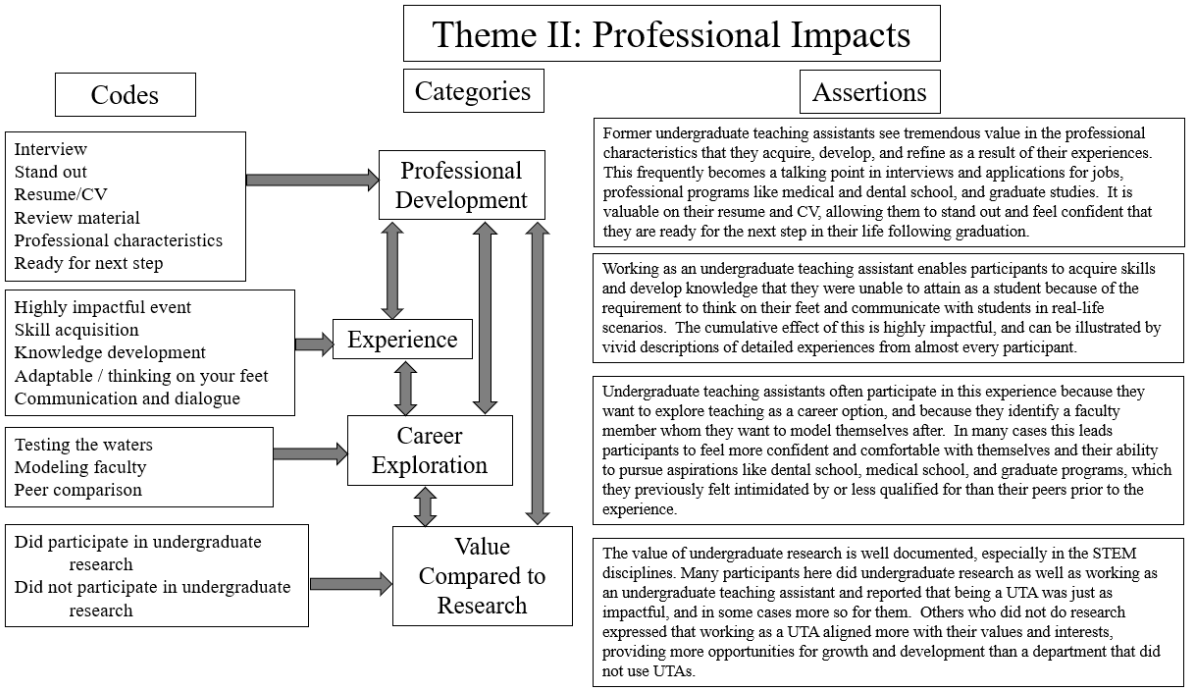

Figure 7: Codes, Categories, and Assertions of the Professional Impact Theme Related to the Undergraduate Teaching Assistant Experience

Category I: Professional Development

Professional Development was the most impactful and valued category in this theme by far, based on the number of codes identified within this category, and the frequency and impactfulness with which they occurred and were described in relation to all other categories within this theme. This category was used to organize descriptions of the UTA experience that related to how it impacted UTA perceptions about pursuing professional roles after graduation and characteristics that were viewed as having been developed as a result of their experiences. Detailed descriptions of the codes within this category are presented in Table 2 of Appendix D. Examples of these included being able to discuss leadership and teaching roles during interviews for jobs, graduate school, and professional programs such as medicine and dentistry, the chance to review material that was beneficial in upper level courses and exams such as the MCAT and GRE, and a sense of being ready for the next step professionally after graduation.

An illustrative quote of the importance of professional development can be found in how Brian described his UTA experience as beneficial in dental school in the following quote:

> So, initially, yeah, it (working as an UTA) was pretty much solely a resume builder. But as I started to do it, like I said, just being able to think differently, to teach different learning styles, I think it's really not an easy thing to do initially. So I figure I got a lot from that. So even, applying it to dentistry, being able to teach my patients oral health, things of that nature - what procedures I am going to do, how I am going to do them, things like that. I didn't really expect to gain that, but I definitely say it was a pleasant surprise.

This quote was selected for a number of reasons. First, it was highly illustrative of the way many participants expressed viewing the chance to be an UTA initially; they saw it as a resume builder. However, participants uniformly agreed that once they began working in that role, the UTA experience became much more than just a resume builder. While it made them stand out, and gave them a unique and attractive feature to list on the resume or curriculum vitae, it also provided them other benefits as well. For example, there was also a complete consensus that filling the role of an UTA provided the opportunity to review materials, and this was perceived as helpful in a variety of manners that ranged from being beneficial in upper level courses to preparing for the MCAT and GRE. Examples of such evidence occurred regularly, such as the statement below by Emily who described thinking about her UTA experience during her MCAT, stating:

> I thought that this (working as an UTA) would be something that was probably even beneficial for me to review upon some of those topics that I didn't… (feel comfortable with) …when I took my MCAT, I was even thinking back to some of the stuff that we did, because it was *so* long ago that I took (General Biology II).

Mabel reported similar feelings when she took the GRE, stating:

> I think that, especially the Concepts of Biology, kind of helped me better understand how everything works together, so how like small cell stuff relates to ecology concepts which relates to chemistry concepts which relates to genetics. Umm, and it helped me kind of make those larger connections when I was taking the GRE and it was asking science related concepts.

Quotes such as those above from Brian, Emily, and Mabel illustrate how working as an UTA helped reinforce content in ways that were beneficial beyond the class, and beyond the semester. Such references to the benefit of reviewing material were made by all participants except Noah. It may or may not be significant that Noah was the only participant to TA in a lab only, and before the implementation of active learning pedagogy within this department. He was also the participant with the greatest gap in time since his experience as an UTA.

The most numerous code within this category was that of "Professional Characteristic", described in Table 2 of Appendix D. This was assigned to examples from the transcripts that illustrated how working as an UTA improved or enhanced the conduct, aims, or qualities of an individual that were perceived to be relevant to their stated career goal or the field they had gone into since graduating. Codes for such examples occurred almost 170 times throughout the course of these 13 interviews, as documented in Appendices H1 through H13. As such, Professional Characteristics were determined to be an axial code within this category, being central or pivotal to all others, and thus significantly meaningful.

One especially illustrative quote of the Professional Characteristic code is below from Adam, who was in the last year of his master's degree at the time of this interview, and whose stated goal was to become a professor. He said:

> When I first started (as an UTA) I wanted to just be like a robot, to be like, if you asked me a question I kind of helped you in a certain way. I learned toward the end to try to make a conversation out of it. You try and guide them and not just give them the answer. You identify points… you learn how to feel out each student and learn where they are at with the question. Because you get some student that they pretty much have it figured out, they just need help with a concept, and then there are students who don't know what is going on. You have to backtrack in time and go back like 3 weeks to help them. That was the thing I think I picked up on, was how to handle each student by feeling out how to help them. They are different, each student is different.

This quote was selected because it demonstrates how this individual perceived his own development as a result of working as an UTA and describes characteristics such as engaging students and differentiating instruction that he feels will be beneficial to his ultimate goal of becoming a professor. It also expresses his comfort and confidence in being able to do these things. This was perceived to be the direct result of his experience as an UTA.

The other code that was determined to be an axial code within this category was the "Ready for Next Step" code. This was a code assigned to examples from participants that demonstrated how they felt more prepared to take on professional challenges because of how they were able to develop as a direct result of their UTA experience. Examples of such discussion occurred more than 90 times across the 13 interviews as documented in Appendices H1 through H13. While this was not as frequent as the "Professional Characteristic" code illustrated above, the significance of such descriptions by participants led to the conclusion that experience as an UTA does indeed impart a sense of being ready for more challenging professional roles upon graduation. Professional characteristics and being ready for the next step were also often associated with each other in the data. An example of this comes from Faith, who is about to finish her master's degree in Clinical Pathology, and stated the following about her UTA experience:

> I learned how to teach, I learned how to think on my toes, I built confidence, I built knowledge. I think I'm a whole different person because of it (the UTA experience). And I don't think I ever would have gotten (that)… if I didn't TA and I just went and got a biology degree. I don't know if I ever would have ended up in research. I don't know, I mean, honestly I can't go back and do it again, I don't want to, but, I don't know if I would have ended up where I did because I, I don't think I would have had the knowledge to go and try and apply for an internship in my junior year especially when I was not actually my junior biology year. And that, I just don't think I would have had the confidence and knowledge, any of that, I wouldn't have gotten where I've gotten without TA'ing.

This quote was selected for a number of reasons. First, it illustrates the direct connection in Faith's own words of the relationship she saw between being an UTA and having the confidence to move into professional roles such as an internship, which ultimately led to her master's degree, being completed in the same lab as the internship mentioned above. It also illustrates the additive benefit of being an UTA compared to just getting a degree. These benefits, and the confidence imparted by such experiences were consistent hallmarks expressed by participants describing how they felt ready for the next step in their life as a result of UTA experience. The quote by Kevin that opened this chapter is further evidence that the perceived benefits of moving forward are not limited only to those students interested in graduate school because Kevin expressed feeling ready for medical school in part because of having worked as an UTA during his undergraduate experience.

These quotes by Adam, Faith, and Kevin also illustrate the connections between the category of Professional Development and those of Experience, Career Exploration, and to some extent, Value Compared to Research. These relationships are shown by the arrows between these categories in Figure 7 above. In all three quotes, it is clear that Adam, Faith and Kevin feel the experience they gained made them ready for the next step in their careers as professionals. In the case of Adam and Faith this step was graduate school, and in Kevin's case it was medical school. All participants expressed feeling ready for those challenges, and such perceptions were shared by all participants at some point during their interviews.

Further illustration of the link between Professional Development and Value Compared to Research was provided later by Faith, who went on to say:

> I mean, basically in (the class where I was an UTA), we literally covered the basic of pretty much all biology, we even got into some ecology and genetics, we just cover the basics of life there, I guess you could say. And so, I mean, I now teach as a graduate student, and I mean, there's never a time when you don't go back to

> that basic central dogma of biology or any other… Punnett Squares. What you learn (as an UTA) is literally used daily in my life.

This quote further solidified the connection between Professional Development and Value Compared to Research by illustrating how the UTA experience provided a foundation that is still used by Faith on a daily basis as a graduate student. Examples like this were common from the interview transcripts and audio files of all participants who had been UTAs and had also participated in research as part of their undergraduate careers.

The feeling of preparedness for the next step professionally after graduation was also present in many participants who did not participate in undergraduate research. Emily presented one of the most articulate and illustrative explanations for this, stating:

> I didn't want to see the research part of it, I really wanted to see how the classroom worked and how being a professor works… I have not (done undergraduate research). And mostly, not because there wasn't opportunities, but mostly because I don't have interest in it. And even when I do my biology labs, I honestly don't have a lot of, and maybe if it was something very specific related to some field in medicine that I was trying to do like drug research on, maybe I could see myself doing that; but not really, or like experimentational research on like, nerves or different things like that, maybe something like that I could see myself doing. But really not like the cut and dry research that most people do. That, it just never really interested me. And I've looked at it even from a couple different angles and I really wanted to see this side of it instead of the research side of it.

This quote was selected because it was an illustrative representation of many participants' feelings about why they did not seek to participate in undergraduate research. Simply put, not everyone is interested in research. The UTA opportunity aligns much more appropriately with the interests of many who desire to pursue a STEM-related field like medicine or dentistry but lack an interest in bench-work or related research experiences. It does so because it allows them to gain experience, develop professionally, and test other careers that require a foundation in science. Such information led to the assertion that former UTAs see tremendous value in the

professional characteristics that they acquire, develop, and refine as a result of their experiences as an UTA. This is often the result of being required to think on their feet and communicate with students in real-life scenarios during class time in order to assist their learning. The cumulative effects of developing and practicing this skill set is highly-impactful on these individuals, who can recount vivid descriptions of detailed experiences from their time working as an UTA. Such experiences frequently became a talking point in interviews and applications for jobs, professional programs like medical and dental school, and graduate studies. They were also perceived as valuable on participant resumes and CVs, allowing participants to feel a sense that they stood out and could be confident that they are ready for the next step in their life following graduation.

Figure 8 below shows the relationship of the axial codes within the category of professional development, and their relation to the other codes of this category. A pyramid diagram was selected because the professional characteristics that resulted from this experience were what made UTAs feel ready for the next steps in their professional lives, and the axial codes related to these two things were the foundation of other aspects that built the overall experience into one that made UTAs feel a strong sense of having developed professionally and being ready for the next professional step in their lives after graduation.

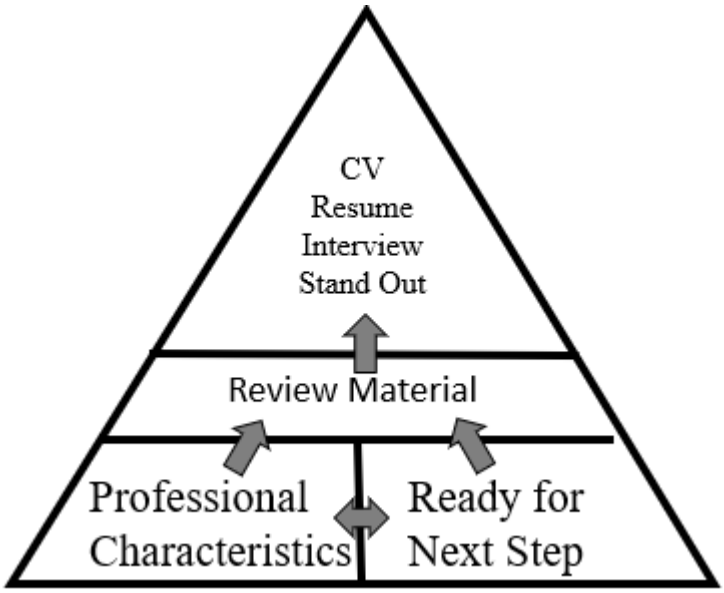

Figure 8: Category I Theme II – Codes Related to the Professional Development Category

Category II: Experience

The Experience category was comprised of five codes that were all related to either a participant's observation of an event and subsequent reflection, or their description of an encounter that impacted them and their knowledge, skill, or ability in the role of an UTA. These events and their subsequent reflections were coded as "Highly Impactful Event" if they caused the interviewee to make profound statements such as something that "changed my life". Descriptions of codes within this category can be found in Table 2 of Appendix D. Julia expressed one of the best illustrations of this in describing how being an UTA led her to her present pursuit, which was returning to school to pursue a career in medical laboratory sciences. Julia was a double-major in biology and science education, who had returned to school to get another undergraduate degree in medical laboratory sciences, and was in her last year of that, completing her clinical year of experience. Julia stated:

> Actually, this is kind of how TA'ing changed my life, because I always wanted to do something with science, but I figured I didn't want to do med school. I wasn't smart enough to do med school so I decided to go into education, like science education.

Lisa echoes some of these same feelings in one of her statements describing how working as an UTA differed from her placement and observations as part of her own science education degree, (she was also a dual science education and biology major) saying:

> My confidence level - I've always kind of been shy and I've never really had an opportunity to be put in that instructor position like as much as I did with that (working as an UTA). Like we have observations or placements (in Science Ed), but it's still, it's not – you don't really feel like an instructor. So this (being an UTA) – I feel like that really helped my confidence. It was nice to have that experience before going into my student teaching experience that I had. I just felt like I was a lot more confident and I was able to kind of distance myself from the student – as "*I'm the instructor*", because I never really saw myself in that position as I would those observations, like in the classroom during the Education program.

To demonstrate that this phenomenon is not unique to only those participants who were double majors in science education and biology, the quote below from Mable is presented again. Mabel stated:

> When I was a student I, and taking biology classes, I didn't really have very much self confidence that I knew the material. Like, I could get good grades, and I could do all my assignments, but I think in the back of my mind I was still convinced that I wasn't really a science person. Cause I didn't like science, when I was in middle school or high school, I had bad science teachers, I had bad experiences with science. So in the back of my mind I still didn't think of myself as a scientist. But once I started teaching, and I realized that I knew these concepts well, and I could teach other people how to do it, it really solidified my self-confidence about biology and I kind of had a new appreciation for my own skill set. So I knew that I knew what I was teaching. and I didn't really get that from taking the courses. I got it more so from teaching them.

These quotes illustrate how the UTA experience impacted the view participants held of themselves, and how this view ultimately helped them develop professionally as they explored

their careers. These relationships are illustrated in Figure 7 by the arrows connecting the Experience category to Professional Development and Career Exploration.

Still within the Experience category, other examples of how participants perceived the UTA experience to have impacted their own knowledge and skill, helping them move into professional roles and careers, can be found throughout every interview by every participant. Appendices H1 through H13 document the frequency and occurrence of this. One of the best representative illustrations of this came from Faith, who, when asked if she could go back in time and provide any advice to herself about being an UTA, responded:

> I would tell myself "*you're going to use these skills every day, going forward, you're gonna have to do this again so if you think it's challenging, just wait. It's gonna get better but, you're going to get even more challenges"*. But yeah, I mean, I learned everything from TA'ing, so if I was to go back and, I don't ever remember being on the fence about TA'ing or not TA'ing, but if I was to ever go back and tell myself anything it would be "*you're TA'ing because it's the best thing you need to do and it's going to get you where you need to go*."

Additionally, Heather illustrated the connection she was able to make with a future employer as the result of her UTA experience, stating:

> So, specifically with that experience (being an UTA), with my previous job, in the interview I thought it really helped me connect better with the PhD student and the master student (who were interviewing Heather for a position). I think they just kind of understood the same situation that I was in since they've had to do teaching, it really helped me connect with them better.

These quotes illustrate the interconnected nature of codes such as "skills" referenced by Faith, "knowledge" implied by all of them, and the ability to "communicate" and be "adaptable" to a variety of situations, which was a consistent discussion point throughout this investigation. As documented in Appendices H1 through H13, the category of Experience had several codes that appeared with nearly-equal frequency, but the code of "Highly Impactful Events" was determined to be the axial code within this category. This was because the discussions that

yielded examples of other codes were almost always contextualized with reference to some event, illustrative story of the time working as an UTA, or in reference to something that occurred which made the other codes important. This led to the assertion that the experience of working as an UTA enables participants to acquire skills and develop knowledge that they were unable to attain as a student because of the requirement to think on their feet and communicate with students in real-life scenarios. The cumulative effect of this is highly impactful and can be illustrated by vivid descriptions of detailed experiences from every participant. Furthermore, these experiences subsequently have a positive impact on the perceived professional development that many of these individuals articulate, and positively impacts their feelings about being able to succeed in their future careers. These relationships are illustrated by the connections between categories in Figure 7. The relationship of these codes within the category of Experience to the axial code of "Highly impactful events" is shown below in Figure 9. A box diagram with the axial code of "Highly Impactful Events" was placed at the heart with the other codes in each corner because impactful events were central to understanding how these experiences impacted the other facets of the UTA experience.

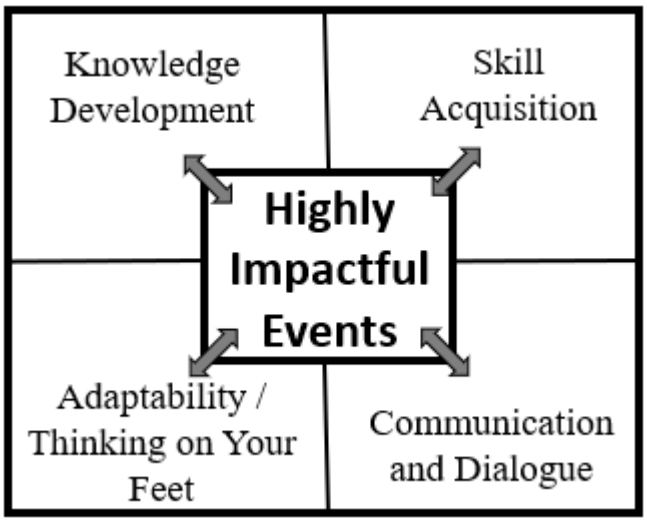

Figure 9: Category II Theme II – Codes Related to the Experience Category

Category III: Career Exploration

The category of Career Exploration was composed of three codes that included "Testing the Waters", "Modeling Faculty" and "Peer Comparison". Descriptions of these codes can be found in Table 2 of Appendix D. In all three cases these codes were applied specifically to examples where participants made explicit references to their experience as an UTA relating to a potential future career. This category was generally associated with the other categories of Experience, Professional Development, and Value Compared to Research because when describing how the UTA experience allowed participants to explore a potential career, it was almost always in reference to these other categories. In other words, participants regularly explained that they were interested in exploring academia or teaching, and saw being an UTA as a way to gain experience that would develop them professionally. Consequently, they viewed this opportunity as being valuable either in conjunction with research, or in place of research.

An illustrative quote that is representative of the category Career Exploration from a participant who did participate in research as part of their undergraduate experience came from Adam, who aspires to become a professor, and worked as an UTA his final semester senior year

after having already been accepted to his master's degree program and did undergraduate research. Adam stated:

> Probably the number one reason would be that I wanted to experience the actual… teaching - Like, informally, I felt like, I'd tutored other students throughout school, but it really had kinda been a thing here or there, but I had never actually been in a classroom helping students answering questions or anything. And I knew I was going to get my master's. I knew that was going to happen, and I was going to need to teach. And I wanted to know what I was getting myself into before I got there. So I kind of used the UTA position - the UTA position was kind of to feel out what it was going to be like, and to practice for me to see how it goes.

An illustrative quote that is representative of the category Career Exploration from a participant who did not complete undergraduate research comes from Lisa, who worked as an UTA three times. Lisa was one of the two participants who double-majored in science education and biology in order to pursue a career as a science teacher. Lisa stated:

> I've always been really interested in biology, and I've kind of always pictured myself as an instructor – a teacher. My whole life I've always known that was where I wanted to go……so like with the education department – they don't really have – I feel like they could have more opportunities to get experience. Like – this is kind of the experience where it was like – okay, I was put into the teacher role, per se, as a TA, and that was where I first pictured myself as being the instructor versus the students. Umm, so that was really nice.

Both quotes above illustrate how the participants viewed the chance to work as an UTA as an opportunity to explore their future careers or "Test the Waters", which was determined to be the axial code for this category. They also are illustrative of the inter-connected nature of this category with the categories of Experience, Professional Development, and Value Compared to Research because of the confidence expressed by these participants as a result of the experience. The category of Career Exploration was determined to be separate from these other categories ultimately based on the motivation of the participants. Codes in this category generally related to what motivated these individuals to become interested in participating or pursuing the experience

of being an UTA, whereas the categories of Experience and Professional Development contained codes that resulted from that experience. Detailed descriptions of all codes in these categories can be found in Table 2 of Appendix D.

An illustrative quote representative of the code "Modeling Faculty" that was also key to career exploration came from Lisa, who described how she modeled her own actions during her student teaching after the faculty she was an UTA with, stating:

> I know during my student teaching experience I thought back to how Diane would set up classes or stuff like that, doing test questions – because there was a point when I had to write some test questions, or do some short quizzes, and I kind of thought back to how she looked at the situation. And how she would do it. Because I really liked her teaching style and how she approached things.

Two illustrative quotes from the code "Peer Comparison" were both used above but are appropriate here again for a number of reasons. First, they illustrate the insecurities felt by a number of these students as they internally compared themselves to their peers prior to or during the UTA experience. By all, accounts individuals who are selected as UTAs are exceptional based on their personalities, work ethics, and grades (Chapin et al., 2014). And yet, many explicitly state that they still felt unsure of themselves prior to the UTA experience, but express gaining self-confidence as a result of this. For example, Danielle stated:

> And in the beginning, it felt like I had no idea what I was doing but (*chuckle*) I came around to it and I figured it out. But um – I hoped to gain more knowledge about introductory biology because that is really the foundation for the whole major, and if you don't know the foundation, you can't build on it. So, like it *really* helped solidify my foundation of biology and I had hoped to gain that from it… Right off the bat I felt like I wasn't smart enough for it. To be honest. I was like "*Well, I'm just a sophomore, I took it, I got an A, but – at both the end of (General Biology I and II) I was like we'll see how it goes - hopefully"*. Hopefully I won't flop because I had no idea what I was doing…So like, this opportunity – how I started off not knowing what I was doing, as I started teaching more and more and helping the students learn, I was also learning.

This perception of not feeling smart enough prior to being an UTA was echoed by Julia

who stated:

> Actually, this is kind of how TA'ing changed my life, because I always wanted to do something with science, but I figured I didn't want to do med school. I wasn't smart enough to do med school, so I decided to go into education, like science education.

An example of a peer-comparison made following the UTA experience comes from Mabel, who has gone on to graduate school where she is now a GTA, and she states:

> So there are 3 ecology labs, I teach two of them and then another graduate student teaches one of them. And I have sat in on her class and she doesn't really, she doesn't really check in with them (her students) to make sure that they're understanding the concepts. And I don't, she didn't TA as an undergrad so this is her first time teaching, but she just kind of goes through her lecture and her in-class exercises kind of like she is on a schedule, but she won't take time to pause and connect with the students. So I think that's something that I learned when I was an undergrad TA and since she just didn't have that knowledge to do that or know that would be helpful for the students...(she doesn't do that).

Quotes such as the first two were re-utilized here because they illustrate how these former UTAs saw this experience as having helped them explore careers of interest, and ultimately develop professionally through the experience. While "Testing the Waters" was determined to be the axial code for this category, modeling themselves after faculty and comparing themselves to peers occurred regularly as documented in Appendices H1 through H13. The last quote above from Mabel was selected to illustrate how these former UTAs continue to compare themselves to their peers following the UTA experience, but in many cases grow to see themselves as more capable and more competent than peers who did not have the benefit of being an UTA. Such examples further support the connection between the categories of Career Exploration, Experience and Professional Development because they illustrate the benefit these former UTAs perceive as a result of the opportunity to test the waters. Such illustrations led to the assertion that oftentimes, participants in this experience want to explore a career option that involves teaching. They identify a faculty member whom they want to model themselves after and are

able to develop professionally through this experience. In many cases this leads participants to feel more confident and comfortable with themselves and their ability to pursue aspirations like dental school, medical school, and graduate programs, which they previously felt intimidated by or less qualified for than their peers prior to the experience. Figure 10 below illustrates the relationship between these codes. A bullseye design was selected for this model because Testing the Waters was at the heart of the experience representing this category, modeling actions and behaviors after faculty mentors was closely related to that and comparing themselves to their peers both before and after the experience was related to that.

Category IV: Value Compared to Research

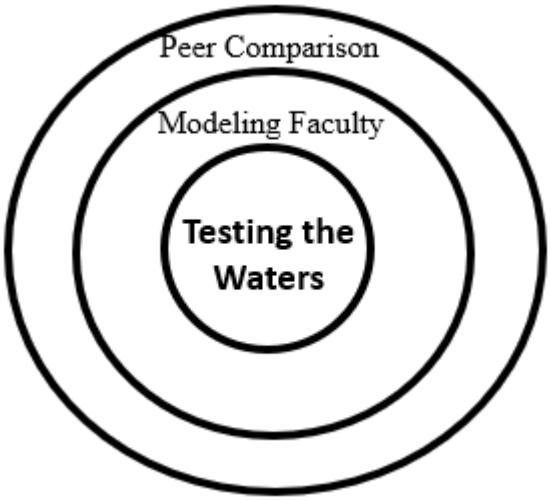

Figure 10: Category III Theme II – Codes Related to Career Exploration

The final category within the Professional Impacts theme is "Value Compared to Research". This category is associated with two other categories within this theme, Professional Development and Career Exploration as illustrated in Figure 7 and contains only two codes. Not all participants took part in research during their undergraduate careers, which prevented several from making any direct comparison about the value of an undergraduate research experience to the undergraduate teaching assistant experience. However, a number of participants such as

Emily, whose quote has been utilized previously, were explicit that they had no interest in research during their undergraduate career because it did not align with their career aspirations, goals, or interests. In general, as discussed above, these individuals found the UTA experience to be a valuable substitute for research.

A truly interesting phenomenon arose from individuals who participated in both research and had simultaneous experience in the UTA role as undergraduates. Seven of the participants here did both, and all except Noah were explicitly positive about the experience of working as an UTA, especially in relation to their experience with research as undergraduates. Noah had three and a half years of undergraduate research experience, which he felt overshadowed his UTA experience, stating:

> It (working as an UTA) definitely would change how you view yourself I guess if there wasn't the, yeah, I guess, if it wasn't something I had basically already had that experience and done before.

Examples of everyone else who had less research experience, and their perception of the relative value between teaching and research that arose in the interview came from Kevin and his discussion about the role he felt it played as part of his admittance to medical school. Kevin discussed the role that both research and being an UTA featured, recounting the portion of his medical school interview that covered his research by stating:

> I know I had to draw an EKG on the board. It was uh, because of my research, that was the only stuff they brought in (from my research).

On the other hand, when discussing the role that his UTA experience played during the interview, Kevin stated the following:

> I wasn't necessarily ever directed to telling about TAing, but I think, as with any interview they talked about past experiences, and I think that the concepts of TAing came up in there - wanting to help people, and feeling better about being a tutor or being a TA. So I think yeah, I think ultimately it did contribute – definitely to being accepted to med school.

These two quotes by Kevin were selected to illustrate this category for two reasons. First, they illustrate the relative value of working as an UTA compared to research by both Kevin and his interview committee for medical school. The term "only" in the first statement implies a sense of disappointment which is especially evident in the audio of this interview. It appears that Kevin is almost disappointed by how little attention the interview committee focused on the research he had done, as if he had expected them to value this more. On the other hand, he becomes excited when discussing the connections he could make with the interviewers when talking about how he felt as a result of helping people during his time as an UTA. This excitement is especially evident in the audio recording.

The second reason these two quotes were selected is because the second quote illustrates the connection between this category and Professional Development. Kevin expressed doing both research and working as an UTA to help get himself into medical school, and when compared with each other, it was the UTA experience that Kevin reflected upon as being the one that contributed most directly to his acceptance into medical school. Interestingly, Noah, expressed completing research as a way to ensure acceptance to graduate school within the department where he worked. This was successful for him because he was admitted, and subsequently completed his master's degree there.

Julia and Lisa, who were both double-majors in biology and science education, and both had experience with undergraduate research and working as UTAs, had a different take on the relative relationship between being an UTA and conducting undergraduate research. Their expressed views aligned with each other. When asked to compare and contrast the relative value of the two experiences, Julia described the following:

> I definitely find value in both of them. Let's see here. Umm, I worked in Joseph's (pseudonym) lab when I was a little bit younger, like my junior year, and my 1st

> senior year… I can't really say if this teaching assistant or research assistant was more important to me. It was almost, just like, sequential, needing one step before taking the next step… I, well, one way I know that I applied it to my teaching was when I was student teaching… I loved [the university's] teaching program but there were a lot of things that I felt I was ill prepared for when I went out and student taught. But the teaching assistant position did help prepare me for that a little bit.

Similarly, Lisa responded

> I think because that (the UTA experience) was more in line with teaching. Because yeah, with research definitely, if I was interested in getting my post-secondary, in getting a PhD, doing research would have been very beneficial, but as far as just doing high school, I thought getting more experience inside of the classroom would be more beneficial.

Lisa went on a little later to explain:

> For me, doing the UTA, I was able to put myself in an instructor position before the time of student teaching. What happens for a lot of students is they don't actually feel in an instructor position until that point in time. So I felt more prepared going into student teaching because of the experience I had UTAing.

These quotes were selected for two reasons: First, they substantiate that both individuals valued the undergraduate research and the UTA experience. Quotes by both are indicative of the value they perceive, substantiating the significance of this portion of the investigation.

Second, and perhaps more significantly, both individuals, who double-majored in science education and biology, articulate a clear link between their own professional development and the value they ascribe to the UTA experience. This validates the connection in Figure 7 between these two categories. Furthermore, Lisa is very explicit in the last section of her quote above that she felt more prepared than her peers to go out and do the student teaching because of the UTA experience. Neither ever made any mention about being more prepared for this because of their double-major in biology, it was the UTA experience that imparted this perception. This further substantiated the link shown in Figure 7 between this category and that of Career Exploration.

These feelings were not unique to Kevin, Julia, and Lisa. Cassandra, who was in her third year of dental school, stated the following:

> Honestly, because I didn't do research, I think that this TAing was really big! When I think about it, I think that me being a TA was a huge bonus on my application…I think it just showed, its – not everyone gets to do it. There are very limited spots in every school (dental), and everybody trying to get them – I was pretty lucky I think to get a spot of the TA, and it's just different. It different than a lot of people have on their applications.

Cassandra then went on to clarify the above statement, saying:

> I personally think that TAing is more my personality. Rather than me doing research on mice that I – you know- I don't know anything about these genes or whatever it may be, and I'm trying to learn about – and I might not even know – I might just have been going through protocol with the research. So I think that the TAing looked a lot better on my application. It was something that I was interested in. I was like "*I like biology! I like teaching*! *I like working with people*." so I thought that was more applicable to me as a person, and not just trying to put stuff on my application just to get in. And that's why I didn't do research. And I knew from the beginning that I wasn't going to do research, because I knew that I wasn't interested in that.

Cassandra's statements here are both insightful and significant because like the other illustrative quotes in this section, she does two things. The first establishes a personal value between the opportunity to work as an UTA and the chance to do undergraduate research. In Cassandra's case she didn't want to do research because it didn't align with her values and personality, even though she explicitly recognizes that it would have had value on her application to dental school. The second thing she does is demonstrate her perception that being an UTA was a better fit for her values and personality, and she confirms her perception that the UTA experience set her significantly apart from others whom she was competing against for a spot in dental school. Similar to Kevin, there are implications that many applicants for these competitive programs do research as undergraduates and working as an UTA helped set

individuals like Cassandra and Kevin apart, leading to their successful admittance to competitive programs of their choice.

The next participant to have excerpts from her interview included here was Mabel, who had gone on to pursue her master's degree. It is worth noting that Mabel was an UTA three times, and participated in undergraduate research for roughly three years, presenting five posters at various professional meetings at the state and national levels. One of these won an award for best student poster (open to graduate and undergraduate students at a time when she was only an undergraduate) at a national conference in her field. Mabel described the progression of experience, and the value she felt toward research and being an UTA in the following statements:

> When I was a TA I was also doing research, and so my career goals then included going into research. I really liked the research and I really liked teaching. So I kind of thought that if I could go into something like being a professor I could do research as well as teach, rather than just doing research. So I knew that when I was TA'ing - that was something that I wanted to continue with - was the teaching aspect of it… And it was interesting when I talk about my research, some of the, some of my favorite things with the research had to do with teaching. So, I loved training the other undergrads… to watch video and kind of mentoring them that way. I loved presenting my posters because I got to talk to people about my research and kind of teach them about this concept that no one had ever done before.

Mabel then went on a little later when asked about the progression of her career and interests:

> Even though I knew I was good at research, I think it was more stressful than anything else. And there were moments where teaching was stressful, like, if I didn't fully understand a concept or someone asked me a question that I didn't really know, that would kind of ruffle my feathers. But I never had the feeling with doing research that was like, what I wanted to do with my life. But when I was teaching, it was like, it just lit this fire. And like, I knew that was what I wanted to do. And I knew that, like, it was so rewarding to me, to teach, and to be teaching something that a student was confused about and then all of a sudden, they flipped on a switch and they understood what was going on, and just to see that look in their eyes! Like, that was the most rewarding thing I think I have ever done.

This quote was selected for inclusion in this section because like the others, it illustrates the benefit that this individual assigned to the UTA experience. It also explicitly connects this category to that of Professional Development and Career Exploration, which further supports the connection between these categories as illustrated in Figure 7. It also balances the perspective that Noah presented at the opening of this section. Both Mabel and Noah participated in roughly three years of research during their undergraduate work and went on to pursue master's degrees. It is possible that Mabel, having worked as an UTA three times compared to Noah's single experience, had a greater impact based on more UTA experience, or that this difference is simply the result of personality. The sample size is too small to be conclusive, but overall, the perceived benefits of the UTA experience are clearly expressed by all participants here.

Figure 11 below illustrates the balance of choosing to pursue working as an UTA, or not during an individual's undergraduate experience. Because there were only two codes in this category and the relation between them was the key feature, both were shown as axial codes.

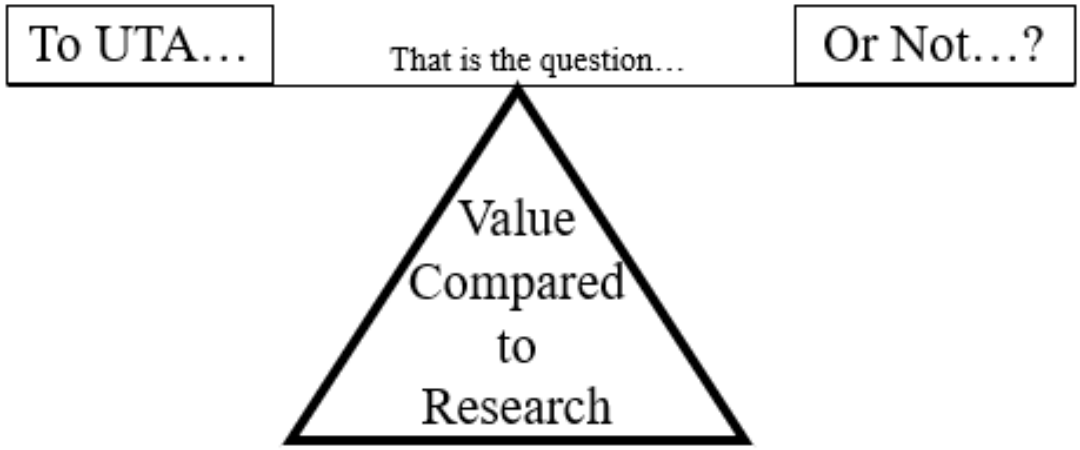

Figure 11: Category IV Theme II – Codes Related to the Value Compared to Research Category

An excerpt from Faith was selected to conclude this section and this theme. Faith went on to pursue her master's degree in the lab where she completed that research as an undergraduate. Faith also worked as an UTA three times. When asked about the relationship between these two experiences and their relative value, Faith stated:

> I wouldn't be a biology major if I wouldn't have TA'd. I wouldn't have loved it. I wouldn't have, I mean, I don't think I would ever have applied to a research program (for graduate school). I don't think I would even be where I am - but I know I've already said that. So I don't think there's just one thing like I can relate back to it. This is the way I went with my path and I just kept building on it, I think it was one thing that I learned, and I just built…I think it's just everything together.

This quote was included for three reasons. First, it confirms the benefit of the UTA experience, which has been discussed by each participant and was the consensus of this group. Second, it continues to confirm the relationship illustrated in Figure 7 between this category and that of Career Exploration and Professional Development. Finally, this chapter opened with a quote by Kevin describing the complexity of the interactions during his undergraduate experience that led him to be successful following graduation. That was selected as the opening of this chapter to show the complexity of these interactions described or grounded in the participant experience itself. The quote by Faith here supports that complexity and confirms the highly intertwined networking nature of many aspects of the undergraduate experience while confirming that being an UTA was perceived as a significant contributor to the success of participants such as herself. Her single quote contains illustrative descriptions of how this experience was perceived as helping her develop professionally, explore her future career, and the value she perceived as a result of this. This addresses every category in Figure 7 that seeks to model the categories that make up the theme of Professional Impacts. This indicates that despite the complexity of these interactions and their perceived benefit, the model proposed here

successfully explains perceptions related to the UTA experience and understanding its long-term impact on these participants.

It is clear based on quotes such as those above that participants here perceive that both research and being an UTA have value, but that many of these individuals value the opportunity to UTA over the opportunity to do research as undergraduates. In some cases, this is because of personality or values. In other situations, it is because of the perception that being an UTA rather than researching was what set them apart from other applicants for competitive fields like dentistry or medicine. But it is noteworthy that this perception is shared by individuals here who went on to medical school, dental school, graduate programs, and careers in education. To be fair, the sample size is small, and a comparative group of students who focused on undergraduate research was not addressed, but it is still apparent that participants here consistently valued the UTA experience as much or more than the chance to do undergraduate research. This is an area that should garner future investigation.

Discussion of Theme II: Professional Impacts with Relation to Relevant Literature

While Lave and Wenger's work on Situated Learning Theory and subsequently Communities of Practice related well to Theme I: Personal Impacts, it was not as relevant to Theme II: Professional Impacts. Ultimately, this was because the codes and categories in Theme II consistently related to motivation that was more externally focused than the codes and categories of Theme I. For example, Theme I dealt with perceptions of self-confidence, a sense of personal reward, a personal sense of belonging to a community, and how individuals regulated and balanced their obligations. All of these consistently have a focus that reflected inward on the participant themselves. Theme II on the other hand regularly focused on external factors such as admittance into a competitive professional program, gaining knowledge or skills that would

make an individual more competitive, and exploring or evaluating a future goal or potential career that is competitive in nature. These involved implied or explicit comparisons of the participant to other individuals, and hence presented a focus that was consistently more external than Theme I.

One theoretical lens that seemed exceptionally relevant in understanding this is Deci and Ryan's Self-Determination Theory (Deci & Ryan, 2002). Their work is centered around the assumption that human beings have an innate tendency to seek growth and integration, and this perspective explains the codes and categories of Theme II: Professional Impacts quite well. For example, Gagne, Deci, and Ryan (2000, 2005) postulate that humans have three innate needs. First is to feel competence, or a sense of control related to mastering some experience or outcome. Second is to relate in a way that connects with others through interactions that allows an individual to feel that they care for others. The third need is autonomy, where individuals seek a sense that they control their life (Gagné & Deci, 2005; Ryan & Deci, 2000).

The need or desire for competence and a sense of mastering an experience is consistently apparent throughout these interviews in sections related to professional development, especially in the axial codes "Ready for Next Step" and "Professional Characteristics" of Figure 8 because these participants consistently relate how the UTA experience made them feel a sense of increased competency. Quotes above by Brian, Emily, Mabel, Adam, and Faith related to the Professional Development Category are especially illustrative of this. Similarly, quotes by Julia, Lisa, Mabel, Faith, and Heather in the Experience category further support this interpretation by demonstrating the sense of connecting to others that the UTA experience offers, and the sense of caring for others predicted by Self-Determination Theory. These quotes also confirm the relationship of the categories of Professional Development and Experience as shown in Figure 7

by demonstrating how being an UTA led to professional development. Quotes by Adam, Lisa, Danielle, Julia, and Mabel in the Career Exploration category illustrate the autonomy predicted by Self-Determination Theory because becoming an UTA was an active choice made by these individuals as a way to take control of their own education and were done in an effort to develop and explore their own career potentials.

Work as far back as 1998 documented professional development by graduate teaching assistants and provided a guideline for training and support programs to maximize their professional growth and development (Marincovich, Prostko, & Stout, 1998). Because of a relative lack of work on UTAs compared to GTAs, primary literature related to GTAs was used as a proxy because of the similarity in their experiences (Chapin et al., 2014). Such guidelines compiled a list of skills, experiences, and advice relevant to promoting the pedagogical development of GTAs, and it would seem reasonable the UTAs going through similar experiences would experience similar benefits. Many of those benefits to GTAs parallel the codes and themes developed as part of this investigation and presented in Figure 7 related to UTAs. Specifically, such works demonstrated that GTAs develop a set of content knowledge and pedagogical skills as a result of their experiences that are highly relevant to future work as faculty (Schonwetter, 2000). These experiences can be predictably traced as GTAs were documented to progress through the stages of "senior learner" to "junior colleague in training" and finally to the role of "junior colleague". A flexible and adaptive nature in the support and training offered to GTAs was shown to help them develop as they struggled with feelings of insecurity as they became comfortable enough in their roles to work with increasing independence (Marincovich et al., 1998; Schonwetter, 2000). This paralleled the experiences and feelings expressed by participating UTAs here, further confirming that like GTAs, UTAs

share similar experiences and gain similar benefits as GTAs (Chapin et al., 2014; Weidert et al., 2012).

Works that specifically included UTAs suggest that, like GTAs, they also experience benefits from serving as a TA. These investigations were all limited to short-term time frames (Chapin et al., 2014; Schalk et al., 2009; Weidert et al., 2012). These works suggest that professionally, TAs at both the graduate and undergraduate level increase their ability to plan, manage students, and develop course material over short-term time horizons such as within a semester. At the same time they network with faculty in a manner that fosters professional relationships while simultaneously allowing them to review material and increase their resume (Weidert et al., 2012). UTAs have also been shown to increase their content knowledge and leadership over these short-term time horizons (Schalk et al., 2009). Working as a teaching assistant has also been shown to improve communication skills in both GTAs and UTAs (DeBeck & Demaree, 2012; Schalk et al., 2009). However, these investigations all followed participants over short-term time lines that were generally limited to single semesters. This work confirms that UTAs perceive such benefits continue over a longer time horizon, and to be broadly applicable to scenarios outside of and beyond their undergraduate education, which is a novel contribution to the primary literature.

Many of the works examined resonated with all of the first three categories of Theme II as shown in Figure 7. Findings of Theme II presented here consistently relate to highly interconnected relationships between professional development related to the experience of being a teaching assistant and the role that often plays as individuals explore academia as a potential career. Despite a significantly larger body of work focused on GTAs, there is a near-perfect alignment with the consistent findings of the work here related to UTAs. Graduate TAs are

consistently shown to develop professionally as a result of their experiences which allow them to grow and test the waters of a potential career while developing a variety of knowledge and skills relevant to professional roles they are likely to fill later in their professional lives. The same appears to be true related to UTAs, as shown in Figure 7. It is noteworthy that a majority of the works examined for this section discuss the professional development of GTAs and contained a focus on their progression toward careers in academia as a result of their experiences. Only one work explicitly addressed the value of these experiences compared to research for undergraduates (Schalk et al., 2009). With such a consistent emphasis on professional development and progression toward careers in academia where, as future-faculty, there would be a need to balance teaching and research, the lack of a comparison between experiences that develop research capacity compared to experiences related to developing teaching capacity represents a significantly under-developed area in the primary literature (Schalk et al., 2009).

Schalk et al. (2009) reported that the UTA experience offered opportunities similar to the undergraduate research experience in terms of knowledge and skill acquisition within the field of microbiology (Schalk et al., 2009). To further investigate this under-developed aspect of the primary literature in the context of UTAs, the primary literature was examined. There is a very clear pattern demonstrating the benefits of participating in research as an undergraduate. A plethora of articles exist demonstrating benefits to undergraduates who participate in research. In the interest of time and space, two large review articles were utilized here as a foundation for this discussion. As recently as 2015, a review article in the prestigious journal *Science* promoted the idea that individualized research experience was significantly beneficial to participants who were contemplating a career in STEM (Linn, Palmer, Baranger, Gerard, & Stone, 2015). Professional development through mentoring by faculty was consistently found to be a

significant driver of such benefits that resulted from these experiences. Other work in prestigious journals such as *CBE Life Science Education* support findings that course-based undergraduate research can be a way to break down a variety of barriers and make entrance into STEM fields more inclusive (Bangera & Brownell, 2014). The mentorship offered to students participating in such experiences was a strong thematic message within articles that promoted undergraduate research as a stepping stone to graduate school, and graduate school as a stepping stone into the scientific community. Based on articles such as these, it is clear that there is consensus within the scientific community about the benefits of undergraduate research.

However, no similar or parallel article was located in any outlet that articulated the benefits of the UTA experience compared to that of the undergraduate research experience. Within the context of this investigation, this is significant for two main reasons. First, quotes by participants such as Emily, Kevin, Julia, Lisa, Cassandra, Mabel, and Faith all make it clear that participants here perceive there to be such benefits, both personally and professionally. In some cases that benefit is perceived to be even greater than the benefit of the research experience, and in others it is perceived to be equivalent. Yet, there is extremely limited work investigating, documenting, or explaining this in the primary literature, representing a significant opportunity for novel contribution that extends well beyond previously reported findings limited to knowledge and skill acquisition (Schalk et al., 2009). The lack of work related to the UTA experience, simply put, begs for a review article comparable to Linn et al. (2015) to be written, but focused on UTAs.

The second reason why this is so significant is a bit more complex and a bit subtler. It is best illustrated by quotes such as those by Emily and Cassandra specifically, because they explicitly articulate that they were not interested in participating in research because it did not

align with their values, interests, personalities, or goals. However, they were still interested in an experience that would promote their entry into the medical field, where the ability to educate patients in fields such as medicine and dentistry would be a significant portion of their responsibilities. Working as an UTA was perceived to provide this opportunity and to have been effective and beneficial years after having participated in the experience. The implication here is that the UTA experience offers a greater number of undergraduates an opportunity outside the formal, structured curriculum which can help them become members of the professional scientific community. Additionally, departments who have not historically utilized UTAs are essentially excluding students who are not interested in research from such beneficial experiences. This means that by promoting the UTA experience, such departments could expand the opportunity for beneficial mentoring and growth to such groups of students who do not see themselves as interested in more traditional research. This proposition supports the existing primary literature and builds upon current understanding, promoting more opportunity for more individuals (Schalk et al., 2009).

Theme III: Financial Impacts

The theme of Financial Impacts provided the most surprising findings of this entire investigation. It is unlikely that Financial Impacts would be a theme presented here if it had not featured so prominently in some of the core literature that framed this study and was utilized to help craft the semi-structured interview questions that guided this investigation. Chapin et al. (2014), DeBeck and Demaree (2012), and Otero et al. (2010), all identify financial benefits to the UTAs mentioned in their works and present the assumption that monetary reward is a significant motivator for their ability to recruit UTAs in their respective programs. As a result, there were a number of questions in the semi-structured interview utilized here that sought to evaluate the

financial motivation and perceptions related to monetary rewards surrounding the UTA experience. In short, the assumption that money was a motivator or that it was a significant benefit was either faulty because financial benefits were not a major factor in the decision to work as an UTA by these participants, or the motivation changed in retrospect or hindsight. Either way, these participants consistently made it clear that financial impacts were in fact not significant when they looked back and reflected on their experience. A series of quotes associated with the codes for this category are presented below to illustrate this, along with explanations of those quotes and participant reactions. Table 3 of Appendix E provides detailed descriptions of the codes within this category. Figure 12 shows the only diagram for this theme, with five codes in a single category that can be simply summarized as stating that monetary reward was not perceived as a major motivating factor here for these participants.

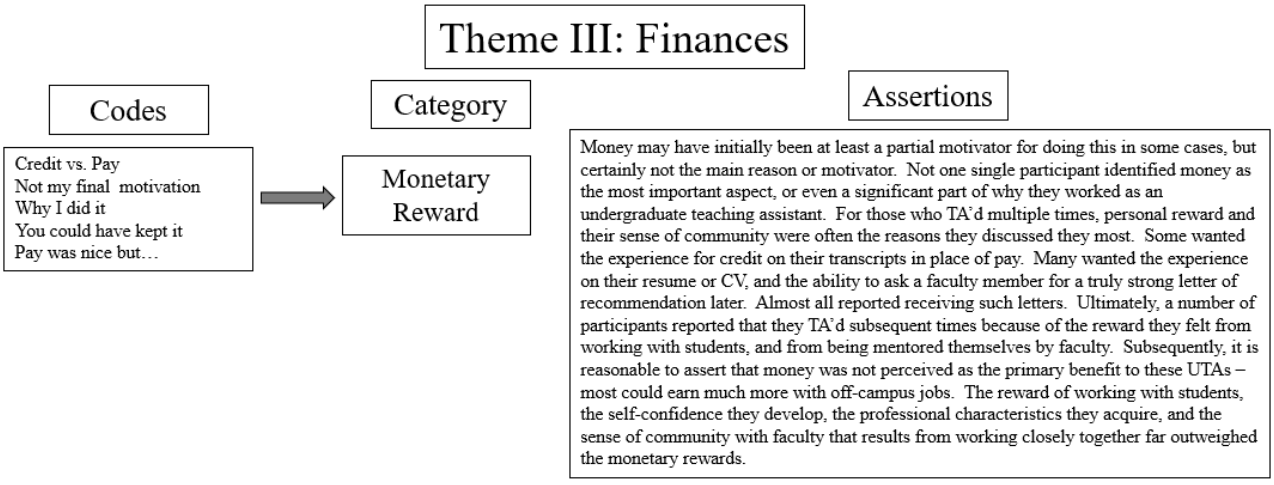

Figure 12: Codes, Category, and Assertion of the Financial Impact Theme Related to the Undergraduate Teaching Assistant Experience

Depending on the semester, UTAs could earn between $500 and $800 over the course of the entire semester. In almost every case, each participant expressed how little the money meant to them in hindsight. One attempt at exploring this asked participants about their interest in working as an UTA for credit or pay. In summary, there was no clear-cut preference for one approach over the other. Some were in favor of credits for the work (a couple even requested credits at the time), others didn't like the idea of doing it for credit because they felt they had enough credits already. One of the best quotes illustrating the views of students who were in favor of credits came from Emily who stated:

> I was still thinking that maybe I would be a professor. I hadn't totally, like narrow minded into the doctor thing yet. So, it was still something I was exploring while getting, it didn't really matter to me that I was getting paid. I actually wanted credits for it, and they wouldn't give it to me. So, yeah, I wanted credits for it and they wouldn't give it to me, so they paid me instead. Which was good too. But I probably would have done it without pay because I really wanted the experience.

This view was countered by a group of participants that felt that being an UTA for credit as opposed to pay might prevent participation because of the additional perceived responsibility. This sentiment can be illustrated by George who expressed his thoughts, stating:

> I wouldn't have been a TA if I had to go through that (taking credits instead of pay) because with taking 155 credits, 156 credits of mostly upper level math and science courses, I didn't have time to take a "*How to be a TA Course*". I'm not saying it wouldn't be helpful, but what I do feel is that it could keep some of the very best, the highest achieving students out of being a TA, just because they don't have time to do that.

Insightfully, George also stated in his discussion about being an UTA for credit versus pay:

> I'm really shocked at some of the things people get college credits for. I think TA'ing is one that's worthy of credit, but, I did it for pay and it was… I could have maybe bought a coffee or something from the pay (*chuckling*), but I think ... It just wasn't, it didn't matter. It was nice, I mean, just filling out the time sheet…but, I don't know, it didn't matter.

The quotes by these individuals show the varied attitude toward being an UTA for pay versus credit but illustrate the consistent consensus that pay was not the primary motivation.

On the other hand, both Emily and George expressed explicitly the importance of faculty members to them and their experience.

Emily illustrated this by stating:

> I saw the value in having a professor in my corner. That was really something that I needed. I needed the experience of being in the university. I wanted to see if this is something I liked. If this is something that I really wanted to pursue as a degree because I knew that I wanted to be in biology, but I knew that if I wanted to teach I didn't want to totally do research, so I wanted to see this part of it. I didn't want to see the research part of it, I really wanted to see how the classroom worked and how being a professor works.

George expressed comparable feelings, stating:

> So, my very first biology class at UND was with Dr. Euphorbia (pseudonym), and, umm, I immediately felt I connected with him. Umm, I enjoyed his course so much I thought the, the passion for teaching and the knowledge of the subject matter that he brought to the course was beyond anything I've experienced and I appreciated it so much that I, I came to (this university) just doing a Bachelor of Science in chemistry and then I added biology as a major after taking that General Biology I, and added him as an advisor… so I think being a TA for him, uhh, the *for him part*, was the most impactful part. He provided any type of support I needed, but the key was that he provided enough room to grow as a TA.

Both Emily and George, despite their contrasting views on working as an UTA for pay versus credit, agree that the true value they saw in being an UTA was the result of the faculty. This confirms many of the assertions from the Personal Impacts theme related to the category of Community. Such sentiments were consistently expressed by all participants here. The relationship they built with their mentors, and the experience they gained as a result of that, were consistently perceived as being more impactful and having a greater benefit than financial rewards.

The only other consistent message that was communicated in terms of why these participants initially chose to work as UTAs related to their career ambitions. A number of participants reported that at first, they saw being an UTA as an opportunity to build their resume or CV to make themselves stand out for competitive positions such as medical school, dental school, and graduate programs. One representative quote of such a view came from Kevin, who stated:

> At first it was probably um… the typical answer of, I wanted to go to medical school and I wanted to look good on my resume. I wanted to do something that stood out a little bit and TAing I thought was a way for me to do that. Maybe that was my first impression of doing it. Maybe like you know, an undergrad teaching setting with Dr. Euphorbia (pseudonym), in the SCALE-UP setting, but I liked the – from those experiences I like helping others and working through the stuff that I knew. And I wasn't so much older than all of these kids – I was basically a year older, so later on, when I went back and wanted to be a TA for lab, it wasn't so much that I wanted to fill out my resume, it was more so – I wanted to be a TA because the TAs when I was going through the undergrad experience, there were ones I remember as being awesome … And it was a setting in which students teach students, and I kind of like that, and I wanted to try to help teach people I guess. I liked that experience. To be honest, when I went and became a tutor for a while that was the reason.

This quote was selected for three reasons. First, there is a notable absence of any reference to financial motivation. Second, typical of many participants, Kevin articulates that he started out being interested in building his resume, but quickly found that the reward of helping his fellow students was something that he perceived as having an even greater impact on him. This further supports the assertions related to the importance of the categories like Community and Personal Reward discussed above in Theme I. Finally, this further supports the interconnected nature of this work that was used to open this chapter, and to conclude both of the first two Themes. Like those closing quotes, Kevin provides a single statement that illustrates the interconnecting, highly networked relationship of the facets of this experience. However, when teased apart, each aspect of this statement that appears to be significant is addressed in the

models developed and connects to other categories as modeled more appropriately in Figures 4 and 10.

Ultimately, this led to the assertion that money may have initially been at least a partial motivator for doing this in some cases, but certainly did not remain the primary reason or motivator. Not one single participant identified money as the most important aspect, or even a significant part of why they worked as an UTA. For those who worked in the role of UTA multiple times, personal reward and their sense of community were often the reasons they discussed they most. Some wanted the experience for credit on their transcripts in place of pay. Many wanted the experience on their resume or CV, and the ability to ask a faculty member for a truly strong letter of recommendation later. Almost all reported receiving such letters. Ultimately, a number of participants reported that they served as an UTA subsequent times because of the reward they felt from working with students, and from being mentored themselves by faculty. Subsequently, it is reasonable to assert that money was not perceived as the primary benefit to these UTAs – most could earn much more with off-campus jobs. The reward of working with students, the self-confidence they developed, the professional characteristics they acquired, and the sense of community with faculty that resulted from working closely together far outweighed the monetary rewards. Appendix I documents the relative frequency and occurrence of codes within this theme's single category and can be compared to that of the other themes. All of those facets were addressed within the diagrams of Themes I and II, and as a result, because financial motivation was not a primary motivator in any case, no further illustrations, models, or diagrams were developed for this theme beyond that of Figure 12 above.

Discussion of Theme III: Finances with Reference to the Primary Literature

Unlike Themes I and II that resulted from the collection, organization, and analysis of the data in accordance with Grounded Theory, Theme III: Finances, was largely shaped by and the result of the primary literature which was used to construct the semi-structured interview prior to beginning data collection. This primary literature suggested that financial motivation or perceived financial benefit was a key determinant in TA participation by undergraduates (Chapin et al., 2014; DeBeck et al., 2010; Otero et al., 2010). In summary, that was not the case with this group of participants. As a result, Self-Determination Theory as discussed above accounted for this finding because participants consistently expressed that they perceived other benefits such as personal and professional growth to outweigh financial motivations over the long-term time horizon of interest here (Deci & Ryan, 2002). Quotes above by Emily, George, and Kevin were all selected to represent this consensus.

There are a number of reasons that could possibly explain this surprising find that finances were not a significant motivation. First, no mention was made in the primary literature used to construct and guide the semi-structured interviews about how much other programs paid UTAs who participated in their programs. Quotes from this investigation indicate that UTAs were paid between $500 and $800 per semester. It is possible other programs paid more, and that difference caused a shift in motivation. Another possible explanation is that those works examined UTAs over a much shorter time period, generally over a single semester, who had not yet graduated. This investigation focused on participants who had since graduated and gone on to other pursuits. This means that participants here were UTAs between two and 10 years prior to this investigation. It is possible that on a similar time-line to those works pay may have been a significant benefit to these participants, but this perspective may have changed with time. It may

also be possible that participants in those studies may change their perspective and perceive personal and professional benefits as being more impactful than pay in the long-term. Without a direct-comparison, or specific investigation, it is impossible to know. A better data-set that followed a cohort of UTAs from the start of their experience and over a long-term time horizon following their experiences after graduation would be required in order to investigate such speculations.

No matter the reason, participants here clearly expressed that the financial benefit of being an UTA was not nearly as impactful as other aspects of the experience such as personal and professional development. This is evident when examining the raw number of quotes related to finances compared to other aspects of the experience as shown in Appendix I. It is further supported when examining the simplicity of Figure 12 illustrating Theme III: Finances in comparison to Figures 4 and 10 illustrating Personal and Professional themes. As a result, it is reasonable to conclude that participants here perceived that they experience more personal and professional growth than financial benefit as a result of their experience working as UTAs.

Theme IV: Concerns Not Supported

At the onset of this investigation one critique of previous works that was presented as a justification for this investigation was a focus only on the positive aspects of working as an UTA, and the inherent bias such a view could present. The semi-structured interview used here and attached as Appendix B was designed in an attempt to gain unbiased answers that allowed participants to express all perceptions about their experiences. Each interviewee was told at the onset that their open, honest, candid responses were valued. Each was explicitly reminded that the interviewer was interested in the positive and negative aspects of their experiences. Additionally, questions were embedded throughout the semi-structured interview in a manner

that attempted to prompt not only positive recollections related to the experiences of working as an UTA, but negative examples as well. Many of these questions were informed by the primary literature used to develop the proposal for this study. Additionally, each participant was asked if they had any regrets about their experiences as an UTA. Figure 13 below illustrates the relationship of these findings. Selected illustrative quotes and discussion of their relevance is provided below. Table 4 in Appendix F provides detailed descriptions of the codes within this category. Appendix G documents the frequency and occurrence of these codes from within the original transcripts.

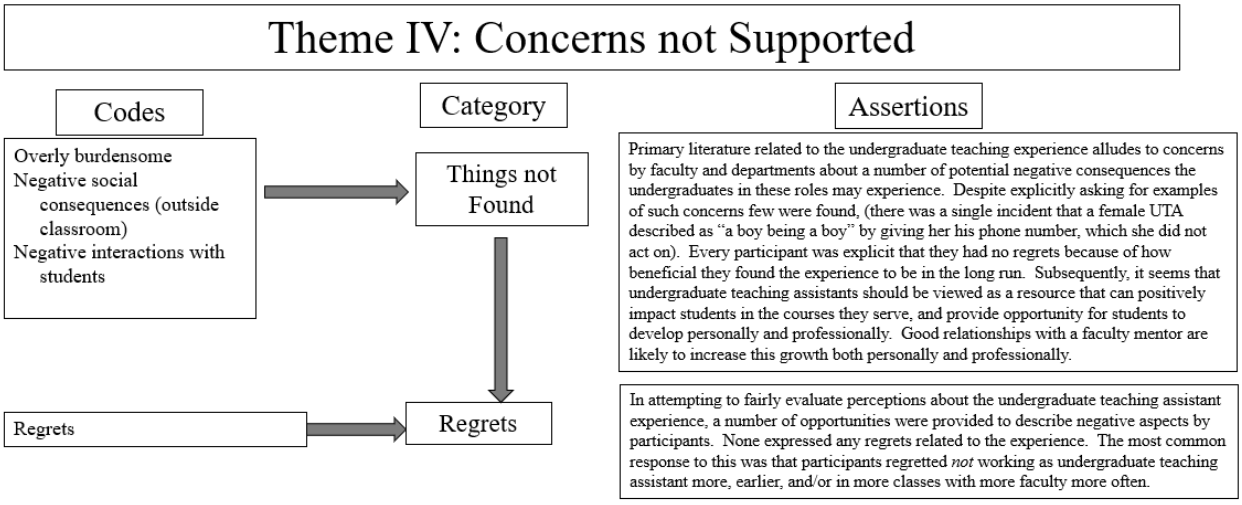

Figure 13: Codes, Categories, and Assertions of Concerns Not Supported

The work of Chapin et al. (2014) addressed any disparities in the quality of instruction provided to students by undergraduate versus graduate teaching assistants, which was not a focal point of this investigation. However, previous works also mention concerns about UTA responsibilities being overly burdensome, concern about negative social consequences in and out of the classroom because of the close age and potential for conflicts of interest, and negative social interactions between students and UTAs (DeBeck et al., 2010; Drane et al., 2014; Patitsas,

2012; Quitadamo et al., 2009; Schalk et al., 2009; Weidert et al., 2012). All participants were asked to recall any examples of such instances, in addition to being asked if they had any regrets related to their experiences, being asked to share negative aspects of their time as an UTA and being asked about burdensome experiences from their time as an UTA.

The few references to some aspect of the UTA experience being burdensome was generally in regard to grading. It is worth noting that most UTAs were not responsible for grading unless they were in charge of their own lab section. In general, those who worked in introductory labs and were responsible for their own sections of those labs were the only ones responsible for grading student work on a regular basis. Others occasionally helped with short assignments from class. One of the few examples of references that were coded as a burden came from Brian, who stated:

> Grading kind of felt like a waste of time, but I understood because someone had to do it, and the Graduate Teaching Assistants had to do it. And the Graduate Teaching Assistants have their own things - bigger problems, and Dr. Poplar is busy, so I understood where that is coming from. Other than that, not really.

This quote was included in the interest of being candid about burdens that were identified. It generally exemplifies what is expressed, and how it is expressed by almost all participants here. In general, it seemed like participants felt obligated to give some response to these questions. But overwhelmingly, when asked about burdens, negative aspects, and other less-than-positive experiences, the responses consistently resembled those above with a short response, and an emphasis on how such things were not truly perceived as an actual burden.

Typically, UTAs are selected because they have a relationship or experience with a class and/or a faculty, and an expressed interest in the topic and the experience (Chapin et al., 2014). This allows faculty to utilize exceptional individuals they have previously identified as students within their classes for the role of UTAs. These exceptional individuals are generally assumed to

be capable of time management that results in the UTA experience not being overly burdensome, and there was ample evidence of this throughout a number of these interviews. For example, Brian stated:

> Balancing school, to be 100% honest, I didn't think undergrad was extremely difficult, so I'd say I didn't have to juggle the academics.

This quote was likely the most direct from the entire investigation about the feelings that these participants had related to balancing their responsibilities. In addition to serving as support for the Balance category of the Personal Impacts theme, the audio of this quote further supported the "Proud but Humble" code within the category of Personal Reward. Based on voice inflection and tone, Brian implies that he knows such a statement could be perceived as arrogant, but was almost sheepish in how he presented this, implying that he knew how it could be interpreted, and consciously made an effort to present this in a humble manner. That inflection is not apparent in the transcript alone.

Kevin expressed similar sentiments when discussing balancing responsibilities and the potential for overly-burdensome workloads, stating:

> I balanced them (multiple responsibilities like being a student and an UTA) well just because I was committed to what I was doing and what I was putting myself into. So when I was a full-time students and a TA I knew that these were my responsibilities, so I made time for them, and I made time to study, and to grade and be a TA.

Like Brian, Kevin makes it clear that he was able to balance his responsibilities in a way that did not detract from his own schooling. Kevin did this by identifying the experiences he wanted and prioritizing his time-budget around those commitments, which related directly to the Self-Regulation category of the Personal Impact theme as well. The close association of this category with the Balance category of the Personal Impacts theme served to further support the relationship between these categories diagramed in Figure 1 and support that model as

appropriate based on evidence from within the data. This was a consistent association when participants were asked about their ability to balance the multiple responsibilities they faced because of the choice to take on the responsibilities of being an UTA in addition to their own school.

The other consistent reason that working as an UTA appears to have not been burdensome was because many of these participants explicitly discussed selecting semesters that they had lower course loads or credit requirements when they pursued these opportunities. An example of this comes from a quote that was used above already by Heather but is illustrative here as well. Heather stated:

> Yeah, I think if I had the same amount of credits I was taking in the spring I don't think that (being an UTA) would have happened… I think I was taking 15 credits or 16. But my spring semester I ended up taking 21 credits, which was a nightmare."

Like the quotes from Kevin and Brian above, Heather's was closely associated with the Balance category from the Personal Impacts theme. She also illustrates the category of Self-Regulation by identifying that working as an UTA is valuable, and then prioritizing that responsibility. There is also a clear illustration of the active decision making that occurred about selecting when to participate in the UTA experience based on other responsibilities and commitments, further supporting the connecting from the Personal Impact theme of the connection between the Self-Regulation category and that of Balance in Figure 1. This was a clear and consistent pattern within the participants here and served as further support that the model for the Personal Impacts theme was indeed appropriate.

Taken together, quotes such as those above and the relationship between categories that they represent presents evidence that UTAs are not likely to feel over-burdened by the opportunity to participate in such an experience for two key reasons. First, participation is an

active choice based on the perceived opportunity and subsequent prioritization that results in appropriate time management. Second, these individuals possess the knowledge and ability to handle the tasks presented to them while balancing their other responsibilities.

Negative social consequences and negative interactions with students were two other codes placed in this category that were created based on concerns documented in the primary literature used to construct the semi-structured interview that was utilized here. A number of papers discuss concerns by faculty or departments about making undergraduates responsible for some aspect of the education of other undergraduates (Chapin et al., 2014; Drane et al., 2014; Weidert et al., 2012). These included examples of anything negative either in or out of the classroom in order to be as unbiased and inclusive of such examples as possible, and to gather as much evidence as possible in an attempt to see if such concerns were warranted. In short, they should always be a consideration, and it appears likely that an emphasis needs to be placed on setting the expectations with students to treat the UTAs as a professional. This is because there was a single example of an interaction between a student and an UTA that was found to be negative. It was described by Cassandra, who had a young male student give her his phone number during class. She describes this scenario as follows, talking about how she would help in the class, and how the scenario occurred:

> So, I walked around and helped with those questions and what-not. And I know one student one day handed me a sticky note and it was his number. And I just kind of like laughed it off. I obviously didn't take action on it. And it was – every time I would see him I would just get these smirks from him, and he was like "when am I going to get to take you out for a drink?" And I was like "*uh…you're a student*". But at the same time I felt like I was a student too, so I didn't feel like I had authority over him.

In discussing this further, Cassandra went on to explain:

> It was definitely a little uncomfortable, because I would see him out at the bars, and stuff like that… I mean, as a girl, I feel like we get this stuff a lot. It's not –

> that wasn't though, the only occurrence of something like this that I've ever had. So you just kind of – it's *another* thing that I just pushed off as like – a guy being a guy. And so, I didn't feel like I needed to tell anyone about it, and I just didn't want to deal with it. And I was like, you know, and then, because I did know that I see him outside of school. I didn't want to have to bring up this whole issue and then see him at the bars and then get grief from him there, that like, "*I can't believe you like brought that up*" like, it wasn't a big deal. So I just felt like "*it was a phone number, let it go*".

This was certainly a negative interaction, and one that was not appropriate to have an UTA endure. The fact that Cassandra states that she had similar experiences at other points in her life, and feels like young females have experiences such as this often, does not lessen the negativity or inappropriateness of the experience, and does not make this any less uncomfortable for her. Likewise, the fact that this was the only truly negative experience shared throughout this investigation does not, and should not, lessen concerns related to such events. This scenario illustrates that there are times when students are likely to overstep boundaries, and that when that happens it will create tension for the UTA, who must decide how to handle that situation.

One other example that was not necessarily negative but that was identified as relevant to concern over social interactions came from Danielle when she was asked if she ever experienced a situation that presented a conflict as a result of being an UTA. Danielle stated:

> Yes, because I was still a student, and I went to a fraternity party, and I ran into some of my students. And they were like "*What are you doing here*?" Because like I said, they all thought I was older, and I'm like "*I'm 20. I'm gonna be here*". Then they were all like "*Oh…can you give me the answers*?" and I was like "*I can't…I really can't*". That I had a conflicting time with because they were my peers and my friends. And like in that aspect I wanted them to think I was cool, but at the same time, like, this is my job, I can't do that.

This quote was selected for three reasons. First, it was one of the few examples of a potentially negative situation or scenario that UTAs experienced. Second, it confirms that there are times when students will over-step boundaries just as was the case with Cassandra above. The final reason it was selected was because it also demonstrates that despite a desire for social

acceptance, individuals in the UTA role prioritize their professionalism and responsibility by explaining that they need to maintain the professionalism of their role as an UTA.

However, there were ample other illustrations of positive interactions between UTAs and students, both in and out of the classroom that result in beneficial interactions. The Personal Reward category in the Personal Impacts theme described above illustrated the rewarding and beneficial aspects that were perceived to have arisen as a result of the UTA experience for these participants. Other examples that should assuage or mitigate the concerns over negative social interactions or consequences are below.

Emily described being a resource for students in the class she was working as an UTA in as follows:

> I had friends in the class (description removed for confidentiality) and I never had anyone ask me like, "*send me the test*" or ask "*do you have it*". All of your students were very respectful and, I actually had a couple out of class that would ask me for help. I had class with 2 or 3 of your students in like a Spanish class and they would ask me questions, in that class, and I would help them with some of the material then.

Many of the participants here described meeting with their students outside of class time to tutor or support them as addressed above in the Personal Impacts theme. Quotes such as this one re-emphasize the point that the sense of community is important to the UTA experience. Utilizing UTAs creates more opportunities for students to have access to someone who they view as an approachable resource. It would be naïve to think that there would not be social interactions between UTAs and their students in other classes, or socially. While the first two quotes from Cassandra and Danielle illustrate that there are times when these situations are not always positive, such examples are rare, and the benefits of the experience are likely to far outweigh the few negative interactions that do occur.

The fact remains however that there are likely to be negative interactions at times between students and UTAs. The sample here is too small to make anything more than a generalization, but it would appear that UTAs are often responsible, mature, and confident enough to handle these situations. However, that does not mean that support by faculty is not critical, and that a good relationship with faculty would likely help mitigate or minimize negative aspects of the UTA experience. Such a relationship, which seems to already exist in most cases, is likely to contribute to the benefit of this experience for participants as illustrated by the quote below by Danielle, who responded as follows when asked about the support she received from her faculty member.

> He understood that there were certain things that I didn't understand. And there was always an open-door policy with Dr. Euphorbia (pseudonym). So if I didn't understand something that was going on I knew to ask him at the beginning of class or we could meet on our time before lecture and be like "*OK. Can you explain this to me so I don't tell it to them wrong*". I maybe didn't remember learning it, or it was just something that I never fully understood." I got *a lot* of support from him! He – before each class he would provide us (The TAs) with the in-class worksheets with the answers on them so that we could help lead students to the right area and the right answer. He also gave us the quizzes – never the exams, but he'd give us the quizzes, so we could help lead them there. We wouldn't give them the answers, but we would help lead them there. Be like "*I think you should maybe think about this*" or something like that. It made it easier to talk to the students. And he sat down with us and helped us figure out how to have the student-TA interactions. He was always like "*Remember – it was you last year, so, answer any questions they have – don't give them the answers, but if you're leading them and leading them and they can't figure it out, then give them the answer, but sit down and explain to them why that is the answer. Help them understand*".

This quote was presented as evidence of three things. First, it confirms the mentorship and sense of community that was developed above in the Personal Impacts theme, confirming the validity of that model, and further illustrating the importance of those relationships. Second, it illustrates the emphasis that is placed on learning by the faculty, and the support that is provided to UTAs as a way to help them succeed. Finally, it confirms that the UTA's role is to

be there for the students as an additional resource in support of learning. This quote, like the opening of this chapter, and the closing quotes of the previous sections addressing each theme further illustrates the complex nature and dynamic structure that exists between faculty, UTAs, and students. Despite this complexity, the models developed here align with those complex explanations, consistently indicating that the models developed to explain these interactions are appropriate.

The final section addresses the code of regret. Each participant was asked if they had any regrets as part of their interview, and the answer was unanimous that they did not. Below are quotes from individuals attesting to this sentiment. These quotes are their responses to the interviewer asking if they had any regrets about working as an UTA during their undergraduate experiences:

Kevin: No, no, definitely not.

Faith: No. None.

Julia: No, I don't. I don't have any regrets about TA'ing.

Brian: OH NO! (*emphatically*) Definitely not!

Heather: No, not at all. I'm glad I did it.

Emily: No. No. None at all.

Lisa: No. I have none (*emphatically*)!

Mabel: I don't think so. I'm really glad I was a TA.

Adam: No…No.

Cassandra: No. I don't.

Danielle: Zero! Zero regrets!

George: Only that I didn't do it for more courses maybe.

Noah: I mean, as crazy as it sounds, uhh, no regrets. I think I'd do it all the same way again.

These quotes, from every participant in this investigation, are meant to further substantiate that there were no regrets by any of these participants related to their experience as UTAs. All consistently expressed that they benefited both personally and professionally over the long-term as a result of their experience.

Discussion of Theme IV: Concerns Not Supported

A relatively small number of previously published papers from within the primary literature served as the foundation for the core of this investigation. These works were selected based on their relevance to understanding the perceived long-term impacts of the UTA experience because they generally examined either a pool of TAs that included undergraduates, or because they examined short-term benefits to UTAs who generally had remained within the same program where they had worked as UTAs, and where the investigators still had direct access to them. This investigation differed from previous work by examining long-term impacts among a group of participants who had graduated since their time as an UTA by asking them to reflect back on their experiences as outlined in the semi-structured interview attached as Appendix B.

Following the interviews and subsequent iterations of analysis, other primary literature was examined in a further attempt to ensure accurate interpretation and presentation of the findings here, as well as to re-examine the original data to ensure accurate understanding and interpretation. There were a number of concerns raised in the primary literature which the investigator subsequently examined in the data. These included concerns about UTA's being overburdened by their responsibilities or time commitments related to working as a TA (Chapin

et al., 2014; DeBeck & Demaree, 2012; DeBeck et al., 2010; Patitsas, 2012; Quitadamo et al., 2009; Weidert et al., 2012). Others voiced concern over conflicts of interest because of the close age-proximity of UTAs to their peers, or negative social consequences between UTAs and their peers (Chapin et al., 2014; Drane et al., 2014; Weidert et al., 2012). Still others expressed concern over the responsibility level of UTAs and concern about how they were spending their time as they carried out their duties (DeBeck & Demaree, 2012; DeBeck et al., 2010; Weidert et al., 2012; Wheeler et al., 2015).

Only two of the works utilized to form the core of the literature review here, or examined subsequently, directly addressed such concerns. Schalk et al. (2009), reported that the vast majority of TAs who participated in their investigation reported "nothing negative" as a result of their experiences (Schalk et al., 2009). Weidert et al. (2012), concluded that the benefits of serving as a TA were likely to outweigh any potential negative aspects of the experience. Findings here confirm such claims. Quotes from Brian, Kevin, Heather, Cassandra, Danielle, Emily, and Julia above were all provided as representative examples supporting the conclusion that participants express a unanimous sense of having had a positive experience. Similarly, a quote from every participant in response to being asked about regrets were provided to conclude this section, and to further confirm to the reader that these individuals all had a positive experience that helped them develop personally and professionally.

Conclusion

There was a high degree of interconnected relationships between the codes and categories within the major themes discussed as part of this chapter. However, four themes were identified and developed here grounded on the experience of the participants and informed by the primary literature. The first attempted to relay the positive personal impacts experienced by participants.

The second reported on the positive professional development perceived as a result of the UTA experience. The third reported on finding that monetary reward was not perceived as a significant long-term impact or motivator for these participants. The final attempted to address concerns from within the primary literature by re-examining the data of participants here and confirming previous conclusions that the benefits to UTAs are likely to far outweigh any concerns about negative impacts as a result of the experience.

To conclude this section and this chapter, a final quote has been selected from a participant in an attempt to substantiate the major ideas presented above because it seems to summarize the feelings of the majority of the participants and continues to illustrate the interconnected relationships of categories within the themes discussed above. It is also meant to relate to the closing quotes of each theme that supported the opening quote of this chapter illustrating the highly complex and interconnected nature of various aspects of the UTA experience. Likewise, it is highly illustrative of the general consensus about how positive the UTA experience was perceived as having been. It was presented by Julia, near the close of her interview, when asked if there was anything the interviewer had not asked, or that she would like to add to help develop an understanding of the perceptions surrounding the UTA experience. The selected quote that concludes Chapter IV comes from a participant who wanted to advocate for the importance of the UTA experience because of how impactful it was in leading her to a variety of experiences that were beneficial as described in this chapter. Julia stated:

> All I really wanted to tell you was that TAing, it kind of opens you up to other experiences that you wouldn't normally find yourself in. And, like…there's one small moment in my life that kind of changed it forever, and I feel like all the tiny stuff to get there was just circumstantial. So, I think TAing is really important and I think it's important to keep undergraduate students in there.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this investigation was to develop an understanding of the perceived long-term impacts related to the undergraduate teaching assistant experience (UTA). In Chapter I, I provided an introduction and overview by summarizing background information from the primary literature to establish the limits of current understanding related to perceived impacts of the UTA experience. Previous works were limited to examining impacts on participants over short-term periods that most often followed UTA development within a semester. Few studies followed participants beyond a single semester, and none examined them longer than a year beyond the experience. All were limited to UTAs who remained within the program or department where they worked as an UTA. None followed them beyond graduation and into subsequent positions in the manner of this investigation to understand the perceived long-term impacts of their experience. In addition to developing the background and limits related to current understanding, I established the purpose, significance, and implications of this investigation in Chapter I. By following a sample of UTAs into their positions after graduation, the goal was to understand the perceptions of former UTAs about the long-term impacts of their experiences. Such an understanding might then be used to make decisions informing the use and support provided to current and future UTAs in an effort to maximize the benefit to students who participate in such programs.

In Chapter II the body of primary literature used to shape this investigation was established. It was crafted by examining current works that document the benefit UTAs have been shown to have on the students with whom they work. Chapter II also constructed a framework to guide this study by examining two bodies of relevant related literature. The first of these were works that examined short-term impacts on groups of teaching assistants that included both graduate and undergraduate participants. The second body of works included those examining the impacts on graduate teaching assistants because there is a much more developed body of literature surrounding GTAs, and the first body of literature indicated that over a short-term time line, the UTA and GTA experience was reasonably comparable, making such work a reasonable starting point to understand the UTA experience (Chapin et al., 2014; Schalk et al., 2009). This further established the gap in primary literature which this study sought to address: Establishing a long-term understanding of the perceived impacts on UTAs, which had not previously been reported.

Chapter III described the methodological approach utilized by this study. Grounded Theory was used to examine interviews that were captured on audio recordings and their transcripts. This examination was conducted in an effort to identify, analyze, and organize findings about significant and meaningful aspects of the experience rooted or grounded in the data of participants themselves. Constant comparison within individual interviews was conducted to identify repeating patterns of data which became codes, and to establish credibility of participants and the information they provided. Comparison between participants was then used to establish the significance of shared aspects of the UTA experience and the relative importance of these experiences. Similar experiences were grouped into categories, and categories were organized into themes representing major common characteristics of the

experience. Visual models were then developed to represent relationships of the codes within each category, and the relationship among categories within each theme. Ultimately, four themes were identified and developed from within this data as described in Chapter IV. A summary of each will follow, along with conclusions that were drawn as a result of this investigation. Chapter V will then close with recommendations based on the conclusions drawn from this investigation.

Theme I: Personal Impacts

Individuals in this study unanimously reported that participating in the UTA experience had a positive long-term impact on their personal lives because it developed their sense of self-confidence, imparted a sense of personal reward, and helped them feel like they were part of a community. They also unanimously discussed the balance they strove for in maintaining their commitments to school with other activities. This balance required a level of self-regulation that was also a key point discussed by each participant. Consequently, Self-Confidence, Personal Reward, Sense of Community, Balance, and Self-Regulation were the five categories developed from within the data relevant to the theme Personal Impacts as depicted in Figure 1 of Chapter IV.

The two most important codes related to the category Self-Confidence were “I can do it…” and “See myself as…”. The first code related to a variety of tasks that UTAs carried out in their role related to supporting student learning. The second of these was connected to how these individuals saw or described themselves. Both worked together in a synergistic manner, as shown in Figure 2 of Chapter IV, because every participant here consistently throughout their interviews expressed how doing things for the students they helped, and the faculty they worked with, benefited them, their feelings about themselves, and ultimately the confidence they had.

These were central features of the other codes within this category that related to management and logistics of the learning environment, and the sense of responsibility that was felt regarding the level of support offered or provided to students.

The three most important features of the category Personal Reward included how being an UTA made participants feel good about helping others, imparted a sense that these individuals could make a difference for the students they supported, and ultimately imparted a sense of humble pride. These axial codes related to the other codes in this category that were associated with the ambitions or aspirations that these individuals had personally regarding what or how they hoped to accomplish for the students they helped. Accounts of how those students shared successes with characteristics like a good grade after struggling with material and seeking help occurred regularly across interviews, as did description of "lightbulbs" or "ah-hah" moments in their students. The relationship of these codes is shown in Figure 3 of Chapter IV.

A sense of community was also developed and maintained long after completion of the UTA experience, as shown in Figure 4 of Chapter IV, which illustrates the third category of this theme. Every participant here agreed that they selected their UTA experience, in large-part, because of the faculty member with whom they worked. In most cases they had this faculty member for class and had an interest in the topic or content as well, but that was not as important to them as the opportunity to model themselves after the faculty member, who in each case, were clearly and consistently viewed as role models. The mentorship received from these faculty members as a result of the working relationship experienced was a consistent point of discussion. That feeling was so strong that most participants reported feeling comfortable enough to have asked for letters of recommendation or references years after their UTA experience with that faculty member and reported receiving strong letters and references in all cases. This

relationship with the faculty was consistently reported to have a positive impact on the sense of community with other TAs at the graduate and undergraduate level, with other faculty, and with the students. Essentially, being an UTA and being mentored by a faculty member was reported to have made these individuals feel more comfortable in the academic community, which resulted in UTAs reporting that they actively sought opportunities to mentor the students in the classes they supported.

School and the value of an education was clearly the priority for each individual in this study as depicted in Figure 5 of Chapter IV, illustrating the relationship of codes with the category Balance. These participants unanimously prioritized their own education, and arranged work, their personal lives, and other responsibilities or interests around that facet of their lives. This prioritization required a great deal of Self-Regulation, which was the last category in this theme, and depicted in Figure 6 of Chapter IV. These two categories were often linked or associated within the data because participants consistently described how they identified opportunities and prioritized their time and effort around those (Self-Regulation category), and then the logistics or requirements of maintaining their school while balancing other aspects of their lives (Balance category).

The opening quote of Chapter IV, and the concluding quote of the Personal Impact section of that chapter, were selected to highlight the interconnected nature of these categories. These relationships are depicted in the arrows of Figure 1 in Chapter IV, which are meant to illustrate the relationship between these categories within this theme. Based on the evidence consistently provided by former UTAs, it is reasonable to conclude that UTAs feel a sense of responsibility for the students they support, and that good mentorship by faculty enables them to feel empowered and confident that they can indeed make a difference for those students. This

feeling imparts a sense of confidence and reward that has long-term beneficial impacts on these participants. At the same time, identifying the UTA experience as one that they would like to have, and making the choices to balance that responsibility with the guidance and mentorship of faculty carries over into other aspects of their lives long after graduation. Such perceptions of persistent benefits help former UTAs understand what is reasonable to expect of themselves in careers, graduate school, and professional school. They often realized that they are far more capable than they may have felt prior to their experience because of what they accomplished. This realization fostered a sense of pride and confidence as a result of their UTA experience, and this was reported to carry over into other aspects of their lives even after graduation.

Theme II – Professional Impacts

Former UTAs unanimously reported four consistently beneficial impacts to themselves professionally. These impacts included reporting a sense of having developed professionally as a result of their experiences, which allowed them to explore aspects of academia or other fields that had an educational component and expressing that the UTA experience was valuable. These views formulated the four categories of the theme Professional Impacts as shown in Figure 7 of Chapter IV. Categories included Professional Development, Experience, Career Exploration, and Value Compared to Research.

In the Professional Development category, the professional characteristics that these individuals felt they gained and developed made them feel ready for the next step in their lives, no matter if that was in a career, dental or medical school, or graduate school. In Figure 8 of Chapter IV, the foundational nature of codes related to such perceptions is depicted. Former UTAs expressed the benefit of having been able to review material, improve their resumes, and feel that they stood out within a pool of applicants for competitive positions. They reported

consistently relying on their experiences as an UTA to connect with interviewers for jobs, medical school, dental school, and graduate school. Their experiences made them consistently feel like they connected to interviewers in such scenarios and could demonstrate in a concrete manner the professionalism they had developed in preparing themselves for such future aspirations.

Many of the experiences that were relayed during interviews centered on highly impactful events as shown in Figure 9 of Chapter IV. This makes sense since participants would seem less likely to recall mundane or unimportant aspects years after their experiences. However, the fact that each individual was able to recall and discuss such events, and the impacts those events had relevant to their own development of knowledge and skill was important in this study. Furthermore, the consistency with which participants related how they learned to be flexible and improved their communication skills as a result of their experiences, led to the conclusion that the UTA experience fosters a variety of opportunities which impart benefit based on the experience participants gained.

In Figure 10 of Chapter IV, the category Career Exploration is illustrated. There was a consistent discussion related to future career goals that had some aspect of education within them. For example, participants in medical and dental school regularly mentioned patient education. Those in graduate school expressed being interested in careers in academia. Nearly every participant expressed at one point in their interview the need to be able to teach in some fashion or capacity in their current or future careers. Many expressed being interested in academia at one point or another. Some had ruled that out, while others were still pursuing it. Yet consistently, the UTA experience was viewed as having offered participants the chance to test the waters for themselves, which is why that code was featured centrally in Figure 10 of

Chapter IV. Modeling faculty behavior, actions, and responsibilities, and comparison of themselves to peers also played a prominent role, because many of these individuals wanted to try and emulate a faculty member. Likewise, as a result of the experience they gained as an UTA, many made comparisons to their peers as they came to the realization that they were in fact capable of pursuing such aspirations.

Figure 11 in Chapter IV, represented as a scale, illustrates the choices presented to individuals who had the chance to work as UTAs and to participate in research at the undergraduate level. It is noteworthy that undergraduate research is a prominent feature of the department at the institution where this study was conducted. Previous work has presented findings which suggest that the UTA experience offers comparable benefit to the undergraduate research experience, which is highly beneficial (Schalk et al., 2009). However, value, as depicted in the fulcrum or pivot-point of Figure 11, is subjective and highly personal. For example, several participants did not do research because they felt it did not align with their personality, interests, or career aspirations. A number of participants did research and worked as an UTA, and generally agreed that both experiences were highly beneficial. The value they perceived was largely related to their personal interests, and in several cases this precluded individuals from pursuing research, making a direct comparison impossible. However, based on the expressed positive perceptions of the UTA experience, the important point is that the UTA experience offered an opportunity to more individuals than if the department did not utilize UTAs, and only supported undergraduate research. This allowed more individuals, with broader interests, the opportunity to develop professionally in ways that they felt were beneficial to getting into medical school, dental school, graduate school, and in interviews for jobs.

Examined together, it becomes apparent that former UTAs feel very strongly that they benefited professionally from their experiences. Benefits included a sense of having developed professionally as a direct result of their experiences as an UTA. The chance to be an UTA allowed for early career exploration so that individuals were able to test the waters of academia and experience being an educator. Many participants felt such an experience was highly beneficial to them in a variety of roles. Oftentimes, this benefit was perceived as being more in alignment with the personal values and interests of individuals who may not have been interested in research. As such, the UTA experience offered the opportunity for significant professional development according to participants here.

Theme III – Finances

In Figure 12 of Chapter IV, the findings for the theme of Finances is summarized. A number of works from the primary literature suggested that monetary reward may be a motivation for students to participate in the UTA experience (Chapin et al., 2014; DeBeck et al., 2010; Otero et al., 2010). These works examined students who were still undergraduates, still in the program where they had worked as an UTA, and examined their beliefs over a much shorter time period. Additionally, it is unknown how much these programs paid their UTAs compared to the department in this study.

Participants reported that monetary reward was not a significant motivator to them at the onset of their experience, and that it was not significantly impactful in the long run. There were mixed feelings about working as an UTA for credit in place of pay. Several participants reported that they would have preferred credit because they felt it would have been beneficial on their transcripts. Others were against working as an UTA for credit because they felt that they already had enough credits and expressed concern that additional credits would be perceived as more

burdensome or stressful. There was a consensus among all of the participants that being an UTA had far more personal and professional impacts than it had financially. It is noteworthy to mention that had financial motivation not featured so prominently in the literature reviewed to shape this study, then "Finances" would not have been a theme presented here. However, this did help inspire the final theme that addressed concerns documented in the primary literature, but which were not supported by the views of former UTA, titled Concerns Not Supported.

Theme IV –Concerns Not Supported

In addition to references that expressed the belief that financial motivation or monetary reward may be a significant motivation for students interested in experience as an UTA such as previously described, other work expressed concerns over burden, negative social consequences, and negative interactions between UTAs and students (Chapin et al., 2014; DeBeck et al., 2010; Drane et al., 2014; Patitsas, 2012; Quitadamo et al., 2009; Schalk et al., 2009; Weidert et al., 2012).

There was little evidence from participants in this study indicating concern about the UTA experience being overly burdensome. Grading was the one consistent topic that emerged, yet this seemed to be more of an annoyance than a genuine burden. Evidence in categories such as Balance and Self-Regulation indicated that participants make calculated and intentional decisions about when they sought to work as UTAs, and they prioritized this opportunity accordingly. As a result, working as an UTA did not appear to be burdensome to these individuals.

The one point of concern identified in this study related to social interactions. Having a female TA given a male student's phone number, and subsequently seeing him in a social setting, or being at a party outside of school and running into students created social tension.

The opportunity for such awkward moments underscores the importance of a good sense of community and mentorship with the faculty and other TAs. While such situations are likely inevitable, the individual interviewed acknowledged that such scenarios were ones she had encountered in other places, and she did not see that situation as a result of being an UTA. She felt it was a scenario encountered by females all too frequently. However, she still emphatically expressed that the opportunity to work as an UTA was beneficial both personally and professionally, and she had no regrets about her experience overall.

This lack of regret was echoed by every participant, as previously presented, with a direct quote for emphasis. Findings such as these align with the suggestion by Weidert et al., (2012), that the benefits of working as a TA are likely to outweigh any drawbacks (Weidert et al., 2012). Overwhelmingly, the participants here expressed the benefit they perceived as having arisen from their time as an UTA. It did not matter how many times they experienced being an UTA, whether in a lecture or lab setting, or who the faculty they worked with were. Benefits were perceived to have been significant, and long-term, and to have persisted personally, and professionally.

Conclusions

This study set out to identify what the long-term impacts of working as an UTA might be. Findings revealed that the UTA experience is perceived to be impactful personally and professionally, and these benefits are perceived to persist for years after the experience has ended. Personally, their self-confidence improved, as did the way that participants viewed themselves. This benefit was a result of the tasks that UTAs were able to accomplish and the sense of responsibility that they felt toward the students they served. They expressed a sense of personal reward because they felt that they were able to make a positive difference for the

students with whom they worked. In turn, it made them feel good about themselves and their role. They also reported developing a sense of community with other UTAs, GTAs, and faculty, and that many of those relationships persisted for years after the experience and beyond graduation. Additionally, they reported being able to regulate experiences they pursued in a manner that balanced their other responsibilities to prevent being overburdened or over-committed.

While this study did not generate a new theory related to the Personal Impacts theme of the UTA experience, Situated Learning Theory and an understanding of communities of practice provided a theoretical lens that contextualized the first theme identified by this study. This was largely related to the role faculty played in establishing a sense of community through the mentorship they provided, which subsequently impacted every other category of Theme I as illustrated in Figure 1 (Lave & Wenger, 1998). Ultimately, the opportunity to work as an UTA was perceived as beneficial to the self-confidence of participants, and made them feel like they were part of a community. These participants also reported feeling a strong sense of personal reward as a result of their experiences.

Professionally, the long-term impacts of working as an UTA were equally positive. Individuals unanimously agreed that the professional development they experienced carried over into interviews later in their life and made them stand out in a range of competitive applicant pools. At the same time, their experience as UTAs allowed them to review material that was beneficial in a variety of aspects later on professionally in their respective fields. Furthermore, their UTA experience helped them feel more adaptable and better able to communicate. At the same time, working as an UTA allowed many to test the waters of careers that related to education. In some cases, this experience helped them develop more than peers in graduate

school who lacked such previous experience and found themselves in a teaching role for the first time. In other cases, it was believed to help educate patients by those entering the medical field, or prepare those who went on to become educators themselves. Finally, whether participants in this study did or did not participate in undergraduate research, they felt that the UTA experience was beneficial to them, and valuable in the long-term even after they had graduated.

Again, there was no generation of new theory related to UTAs and their professional development as a result of this investigation. However, Self-Determination Theory was identified as a highly relevant lens from which to view the Professional Impacts theme. Codes and categories consistently related to how former UTAs expressed feeling a positive sense of control over their own professional trajectory as a result of working as an UTA (Ryan & Deci, 2000). Self-Determination Theory suggests that all individuals strive for such control, and an experience that allows individuals to gain a sense of having that control would be predicated to be beneficial.

While there were examples of concerning incidents reported as part of this investigation, these were very limited, and participants were quick to point out that the benefits far outweighed such incidents. Participants were unanimous in how firmly they consistently expressed these feelings. Findings from this study ultimately support a claim by Weidert et al. (2012), that the benefits of working as an UTA are likely to outweigh any drawbacks. Furthermore, this work demonstrates that the benefits of the UTA experience are perceived to persist beyond the undergraduate education and through transitions to graduate school, professional programs, and careers, supporting claims by Schalk et al. (2009). As a result, this investigation concludes that former UTAs perceive there to be positive long-term benefits personally and professionally that

persist for years following their graduation and into professional programs, graduate school, and careers.

Recommendations

Upon completing this investigation, there are a number of recommendations that can be made based on the findings. Participants overwhelmingly and unanimously agreed that the UTA experience they were a part of had a positive long-term impact on them personally and professionally. A number of works previously illustrated concern that faculty typically voice when considering if UTAs are appropriate for their department, program or class. Recommendations that follow are meant to address these concerns, and to guide faculty in making decisions that allow them to successfully implement and support UTAs in their programs.

Prior to implementing the use of UTAs, faculty should take care to do the following:

1. Select UTAs who are intellectually high-functioning, ambitious, motivated, and possess an approachable personality. When possible, use former students with whom the faculty member has positive experiences.
2. Recruit future UTAs by encouraging students to consider being an UTA at the time they are enrolled in the class. This can instill a greater sense of responsibility in these students and give them a goal to work towards. It can also incentivize long-term learning and help them feel like part of a community early on in their academic careers.
3. Provide interested candidates with the opportunity to work as an UTA for pay or for credit. Consideration should be given to everyone's personal circumstance and career goals.

Once UTAs have been selected, the following recommendations can optimize the experience for everyone.

1. Model good behavior such as a positive attitude and professionalism at every opportunity. Remember that the faculty member sets the precedent for the course and doing this for the UTAs will set the precedent for them doing the same for the students.
2. Meet with UTAs on a weekly schedule to discuss pedagogy and communicate expectations clearly and consistently. Make sure to give them a chance to ask questions and provide input about the activities that the class will engage in.
3. Implement multiple TAs whenever possible. Multiple UTAs will foster a stronger sense of community that also provides the UTAs with a resource other than the faculty member.
4. Emphasize to students that they are to treat UTAs with the utmost professionalism and respect. Consistently stressing these expectations will reduce the chances of negative social interactions between students and UTAs.
5. Treat UTAs and GTAs equally, especially in front of students. Such treatment will reinforce to students the expectation that they maintain professional and respectful treatment of these individuals.
6. Support the efforts of UTAs with praise and reward whenever appropriate. Positive reinforcement will help promote good behavior that benefits the students.

Finally, the last recommendation can be conducted at any point during an academic period but is strongly recommended at the end of any academic period when UTAs have been utilized.

1. Conduct some form of review or debriefing session that assesses the strengths, weaknesses, and opportunities for improvements surrounding the experience of the UTAs. Gathering such information can allow the faculty member to make changes that continually improve the experience for subsequent UTAs, and the students they serve.

Reflections

I have been an advocate for the expanded use of UTAs for a number of years based on personal experience, anecdotal evidence, and documented short-term benefits to UTAs and students already established in the primary literature. This investigation provided me the opportunity to test my own beliefs. As the semi-structured interview outline in Appendix B indicates, I made significant attempts to learn about positive *and* negative aspects of the UTA experience, and the perceived long-term impacts it had on participants. Getting individuals to talk about the positive aspects was easy. Questions about negative aspects were often met with long pauses, occasionally hollow answers, and oftentimes, responses stating blatantly that there was nothing negative about the experience. The closing quote by Julia in Chapter IV was perhaps the best illustration encountered in support of both the importance, and the benefit of the UTA experience.

This investigation allowed me to formalize my understanding of the UTA experience. Specifically, it is the first to address the long-term impacts of that experience, even if the sample was limited. Additionally, it provided me the chance to examine the primary literature in a detailed fashion. In that examination, it became apparent that there are a number of reviews dealing with the benefit of the undergraduate research experience, and the benefit of UTAs to students, yet nothing providing a comprehensive review of the benefit to UTAs themselves. The

body of primary literature gathered for this work represents an excellent opportunity for adding to the primary literature.

Finally, I utilized the Grounded Theory approach because I wanted to round out my own personal experience with a qualitative study. I have gained an appreciation for the time and effort such work takes, and the understanding it can generate. I did my best to present the voice of the participants. While I have been an advocate for UTAs, this investigation solidified my feelings about the benefits surrounding UTAs to participants and students alike.

APPENDICES

Appendix A
Invitation to Participate

Dear *Participant (name personalized for each individual)*,

Your contact information has been provided by the UND Biology Department as part of an exploration about the experience of students who have formerly worked as undergraduate teaching assistants within the department. This work has been approved by the Institutional Review Board (*IRB permission number IRB-201709-054*) and is part of my dissertation. I am contacting you to see if you would be willing to participate in an interview about your experience as a teaching assistant, and your perceptions about the long-term impacts of that experience. If you would be willing to participate in such a study, please respond back to this email, or contact me using the information below, letting me know a time and method that would work for you. Because this is part of my dissertation, I would be tremendously grateful for any and all help you are willing to provide. I would love the opportunity to interview you and am willing to meet face-to-face if you are located close to Grand Forks, or over the phone if that is more convenient, at any time that is agreeable to you. Additionally, if Skype is preferable, I am happy to arrange that as well. Again, any assistance you are willing to provide will be tremendously appreciated.

I am attaching a copy of the informed consent statement, and an outline of the questions I am hoping you will discuss with me if you choose to participate. If you are willing to participate, these documents outline details of the study which you may find informative.

Thank you for your time and consideration. Please feel free to contact me if you have any questions or are willing to assist me.

Sincerely,

Christopher J. Felege

Instructor of Biology, University of North Dakota

Ph.D. Candidate – Teaching and Learning

Office: 701-777-6419

Email: chris.felege@email.und.edu

Yes, I would be willing to participate in an interview, estimated to be approximately 45-60 minutes in length, related to my experience working as an undergraduate teaching assistant.

If there is a day or time that you prefer, please circle it below:

Day:

Mon Tues Wed Thurs Fri Sat Sun

If you are willing to participate, and there is a time that is more convenient to reach you, please indicate it below (Central time preferred):

The best time to call me is: _____

If you are willing to participate, please provide the best number below for me to reach you at:

The best phone number to reach me at is:

If you would be willing to use Skype instead of a phone call, please clearly print the contact information you would like me to try and reach you at via Skype below, and indicate your preferred day and time.

Skype contact info: _____

Appendix B
Semi-Structured Interview Outline

Semi-structured Interview Outline

Purpose of the investigation: The purpose of the proposed work is to examine the perceptions about the long-term effects of working as a UTA by individuals who formerly worked in that role in the Department of Biology at UND.

The Research Question I would like to address through these interviews is: "What are the perceived long-term effects of working as a UTA?"

Aspects I would like to address include:

1) *Did this experience impact you personally in any way?*

2) Did this experience impact you professionally in any way?

3) Did this experience impact you financially in any way?

I will do an introduction of myself and my project, and then ask for consent to record participants, and outline the interview I would like to do. If the interviewee is not local, I will ask if they have received the Informed Consent Form, if they have any questions, and if I may have their permission to proceed. (I will be happy to mail them a hard-copy, with a return envelope).

Part 1 – General Background and Demographic information – Interviewee will be reminded that participation is completely voluntary, greatly appreciated, and that their open, honest, candid responses are most helpful. For the first part, I just want some basic, general, brief background info on them.

Q: So, in 1 or 2 sentences, can you tell me about yourself and the following points. - *Ask participants to tell a little about themselves – age, gender, profession, SES, race, and anything else they are willing to share*.

1. When did you work as a UTA; approximately how long ago, and what point in your academic career?
2. Why did you TA?
3. What course or courses did you TA in? How or why did you select those courses as one(s) you were interested in TAing?
4. Did you have an undergraduate TA in any classes when you were a student, and did that impact your wanting to TA?
5. What kind of help or support did you get from the faculty member whom you TAd for?
6. Did you get help or support from anyone else, and if so, who? Did it help?
7. Can you tell me about the career goals you had when you were an undergrad around the time you worked as a TA?
8. Did you hope to gain anything from the experience of TAing?

9. At the time, did you see yourself gaining anything from the TA experience?
10. Did TAing change how you viewed yourself?
11. Did TAing change your career interests or goals?
12. Has TAing changed the way you think about problem solving?
13. Were there any positive experiences from your time TAing that really stand out, and can you tell me about them?
14. Were there any negative experiences from your time TAing that really stand out, and can you tell me about them?
15. Do you think that TAing impacted your goals professionally?
16. Do you think TAing impacted your ability to achieve those goals?
17. What was the most rewarding thing about TAing?
18. Are there any drawbacks or downsides that you would be willing to share?
19. Can you think of a time that you had to balance your responsibilities as a TA and as a student?

Once I have the basic background info, I want to move into the second part of my interview.

Part 2 – Questions based on specific inquiries

Personal Impact 1

1. I would like you to try and think of a time since you TAed when you thought back to that experience. Has there been such a time, and if so, can you tell me about it? What caused that thinking, why did it happen, and what caused it?

Personal Impact 2

2. Do you think that your time and experience TAing helped you reach the goal, or achieve the objective you were interested in when you started? Would you be willing to share a little about why you TAed, and how or why it did or didn't help?

Personal Impact 3

3. Was there anything about the TAing experience that you can think back to and reflect on that you feel like really stands out as having impacted you? Why? What was it about that experience that makes it stick with you?

Professional Impact 1

4. Can you tell me a little about what you have done professionally, related to STEM in particular, since you graduated?

Professional Impact 2

5. Is there anything from your experience TAing that has impacted this path you have taken since you graduated?

Professional Impact 3

6. Do you think you were more prepared to take those challenges on because of your experience TAing, and if so, how or why did TAing help you do that (or not)?

7. Have you ever had an experience that made you think something like "Wow…I am really glad I TAed because…" and if so, can you tell me about it please?

Perceptions 1

8. If you could go back in time right now and tell yourself one thing about TAing, especially in relation to where your life and career have gone since that time, would you do it, and if so, what would it be, what would you tell yourself?

Perceptions 2

9. Do you have any regrets about TAing?

Perceptions 3

10. Is there anything that I haven't asked which you think I should, or is there anything you would like to tell me about regarding your experience TAing and the impact it had on you?

LAST QUESTIONS:

Closing 1

Is there anything that you feel could be or should be done to have made the TA experience better for you as a TA?

Closing 2

Is there anything that you feel could be or should be done to have made the TA experience better for the students you served while you were TAing?

Conclusion 1

Thank you for your time today! Is there anything you would like to add, or that you think I should have asked about that I did not?

Conclusion 2

I will provide you with a copy of the transcript from this interview that you can verify for accuracy and clarity, and that should take approximately 2 weeks. What is the best way to get that to you?

Conclusion 3

And finally, may I contact you again for a follow-up if I have questions, or further clarification or insight based on what my work?

I want to thank you again for helping me, the department, and the college by giving your time, and providing this valuable insight and thoughtful, honest responses. Thank you! Please do not hesitate to contact me if you have any questions, or think of anything else that you would like to add.

Appendix C

Table 1. Summary and Description of Codes for Theme I; Personal Impacts

Theme 1: Personal Impacts	
Category I: Self Confidence	
Codes	Description of Transcript Receiving such Code
I can do it…	Tasks that were completed as part of the UTA experience, often associated with *hesitation at the onset, but which participants became comfortable or confident with*. Included sections of transcript that related to grading, running reviews, tutoring, and related tasks.
Responsible for students	Expressing *a sense of responsibility for student* engagement, emotions, or performance. Sections of transcript were assigned codes that corresponded to remarks provided by participants related to their perceptions and descriptions of how they were responsible for these aspects of the students they worked with.
See myself as…	Descriptions of *filling a variety of roles* including support, intermediate, filter, and example or model for students they work with, was consistently associated with a sense of self-confidence. Codes for these were assigned to portions of transcripts that related to how they defined or described themselves in their role, along with actions they took in those roles.
Student management	Discussing *logistics of a classroom, lab, lecture, or other environment* where UTAs supported student learning by managing or taking control of various scenarios or directing some aspect of that environment to elicit a desired outcome as students completed tasks.
Category II: Personal Reward	
Codes	Description
Lightbulb moments	Descriptions of students who experienced "*ah-hah" moments* or were described as having a "lightbulb" go off as a result of UTA intervention, support, or help.
Grade success	Discussion about *students who earned better grades* as a result of UTA support.
Feel good	Faculty trust and support, student gratitude, and descriptions of *generally positive* interactions made these UTAs express or describe feeling good, or *a sense of personal reward*, about themselves and their roles.
Ambitions or Aspirations	There was also a sense of reward as these UTAs explored their *career aspirations or ambitions* and satisfying *a desire to help other students* as they tested the waters to see if being a graduate student or professor was something they would find personally rewarding.
Making a difference	Many expressed that they *felt they had made a difference* for the students they worked with, especially in high-enrollment active learning classes.
Proud but humble	All of these former UTAs felt a sense of *pride about their ability* to assist their fellow students, but *simultaneously were humble* about their abilities to do such things.

Table 1 cont.

Category III: Sense of Community	
Codes	Description of Transcript Receiving such Code
Association with…	Codes for association with other UTAs, GTAs, Faculty, and students were all applied respectively to text where participants discussed or described the *importance of interactions, associations, and/or relationships with these respective groups* in a way that related to a sense of community between two or more individuals within these groups of people.
Mentoring by faculty	This code was applied to any *description of faculty mentoring, guiding, and/or supporting the UTA* during their experience.
Mentoring of students	This code was applied to any *description of UTAs mentoring, guiding, and/or supporting the students* they worked with during their experience.
Faculty are the primary motivator of community	Almost every participant described the *importance of the faculty* (and usually an interest in their class) to selecting who they TA with. Sections of transcript that detail or describe the importance of the faculty, and why being a TA for that specific individual were assigned this code.
Category IV: Balance	
Codes	Description of Transcript Receiving such Code
Work	This was applied to any reference in the transcript that described *balancing the responsibilities of a job or work* with any other aspect of their life.
School	This was applied to any reference in the transcript that described *balancing the responsibilities of school* with any other aspect of their life.
Personal life	This was applied to any reference in the transcript that described *balancing the responsibilities of a participant's personal life* with any other aspect of their life.
Other responsibilities	This was applied to any reference in the transcript that described *balancing other responsibilities* of a participant's life with something not meeting the criteria of the above codes.
Category V: Self-Regulation	
Codes	Description of Transcript Receiving such Code
Identify importance of experience	This was applied to sections of text where a participant explained *how or why they evaluated two or more potential options* available for them to pursue, and the relative importance of each.
Prioritize importance of experience (over another)	This was applied to sections of text where participants explained how they *assigned value to making decisions about how or why to pursue one opportunity over another*, and why.

Appendix D

Table 2. Summary and Description of Codes for Theme II; Professional Impact

Theme II: Professional Impacts	
Category I: Professional Development	
Codes	Description of Transcript Receiving such Code
Interview	This code was applied to transcript text where participants described how they either hoped the UTA experience would help them in an *interview,* or how it actually had.
Stand Out	This code was applied to transcript text where participants described any way that either hoped the UTA experience would help them stand out or *be more competitive* in any professional category not assigned to other codes in this category.
Resume	This code was applied to transcript text where participants described how they either hoped the UTA experience would help *resume or CV,* or how it actually had.
Review material	This code was applied to transcript text where participants described how *reviewing material* helped prepare them for upper level classes, entrance exams such as the MCAT or GRE, or positions they later held that they utilized content knowledge they gained or reinforced as a result of being an UTA.
Professional characteristics	This code was applied to any description where participants implicitly or explicitly described how their UTA experience helped them *develop an attribute* that was beneficial to them professionally following graduation.
Ready for next step	This code was applied to text where participants expressed a sense of being ready or *prepared for some aspect of their professional life* that followed the UTA experience as a direct result of that experience.
Category II: Experience	
Codes	Description of Transcript Receiving such Code
Highly impactful event	Any transcript text that described a highly impactful or *meaningful* event was assigned this code.
Skill acquisition	Sections of transcript detailing some ability or talent that UTAs became capable of *doing* as a result of being an UTA.
Knowledge development	Reference or descriptions to information or experience that participants *learned* as a result of their experience.
Adaptable / thinking on your feet	The ability to *adapt and be flexible* was consistently brought up as something that UTAs became comfortable with as a result of their experiences.
Communication and dialogue	Talking with students and *conveying ideas in multiple, differentiated manners* was a key feature of all interviews.

Table 2 cont.

Category III: Career Exploration	
Codes	Description of Transcript Receiving such Code
Testing the waters	Any reference to the UTA experience being used to *evaluate potential careers was* assigned this code
Modeling faculty	Sections of transcript describing how UTAs displayed traits or characteristics that *mimicked their faculty mentors* were assigned this code.
Peer comparison	Transcript sections where *participants compared themselves with other* students relevant to ability, or other applicants for positions were assigned this code.
Category IV: Value Compared to Research	
Codes	Description of Transcript Receiving such Code
Did participate in undergraduate research	This was applied to text where participants who did not do undergraduate research discussed why, and the *relative value they perceived of research to their interests, and why being an UTA was better for them.*
Did not participate in undergraduate research	This was applied to text where participants who also completed undergraduate research *compared and contrasted the relative values of both*.

Appendix E

Table 3. Summary and Description of Codes for Theme III; Finances

Theme III: Finances	
Category I: Monetary Reward	
Codes	Description of Transcript Receiving such Code
Credit vs. Pay	Assigned to text discussing thoughts of being an UTA *for pay compared to doing so for credit*.
Not my motivation	Applied to text that *explicitly addressed any motivation other than pay* for why a participant was motived to pursue the UTA experience.
Why I did it	Applied to text that explicitly stated a participant's *reason for becoming an UTA*.
You could have kept it	Any example of a participant *downplaying the importance of pay in respect or regard to favoring another aspect* of what they gained from the experience.
Pay was nice but…	Any example of a participant *expressing appreciation for pay, but explaining the greater importance of another aspect* of what they gained from the experience.

Appendix F

Table 4. Summary and Description of Codes for Theme IV; Concerns Not Supported

Theme IV: Concerns Not Supported	
Category I: Monetary Reward	
Codes	Description of Transcript Receiving such Code
Overly burdensome	This code was applied to any text that addressed *burden associated with workload or responsibilitie*s, either positive or negative.
Negative social consequences	Applied to text that discussed *any aspect of social interactions* between students and UTAs outside of the classroom and unrelated to activities related to the UTA position like tutoring and reviewing.
Negative interactions with students	Applied to text that addressed *any negative interaction* between UTAs and the students they worked with in any setting, in or out of the classroom.
Category II: Regrets	
Codes	Description of Transcript Receiving such Code
Regrets	This code was applied to any text related to responses inquiring about regrets from the UTA experience.

Appendix G
Summarized Location and Frequency of Personal Impact Codes by Participants

Appendix G1 – Summary of Personal Impact Code Locations for Adam

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	4-14, 5-21, 7-41, 9-58, 9-62, 10-72, 12-85, 12-88, 14-98, 14-101, 14-103, 15-109, 17-122, 18-4, 19-6, 23-35, 23-38, 24-42
	Manage students	9-60, 14-101, 14-103, 15-109, 18-4
	See myself as…	4-14, 5-21, 7-41, 9-58, 9-62, 12-83, 12-88, 14-103, 15-109, 18-4, 19-11, 22-33, 24-42, 25-55, 26-64
	Responsibility for student	9-60, 10-72, 11-78, 12,80, 15-103, 16-117, 21-22, 25-55
Reward	Lightbulbs	13-91, 15-107, 21-22
	Grade success	
	Feel Good	9-62, 13-91, 15-107, 25-55
	Proud but humble	8-58, 9-62, 13-91, 15-107, 21-22, 25-55
	Aspirations or ambitions	4-12, 5-21, 5-27
	Make a difference	11-78, 12-80, 15-107, 16-117, 25-55
Community	Association with	6-38, 8-47, 15-107, 16-117, 24-55
	Mentoring by faculty	6-38, 7-41, 7-45, 24-55
	Mentoring of Students	7-41, 26-62, 24-55
	Faculty = who and why	6-36, 7-45, 24-55
Balance	Work	17-122
	School	6-38, 17-122
	Life	
	Responsibilities	17-122
Self-Regulation	Identify	5-21, 8-58, 17-122, 25-55,
	Prioritize	5-21, 8-58, 17-122, 25-55

Appendix G1 above shows the location of each individual Personal Impact code, by category, within the transcript for Adam. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 4 in box 14 of the analyzed Personal Impact transcript.

Appendix G2 – Summary of Personal Impact Code Locations for Brian

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	5-19, 6-26, 8-35, 9-51, 11-64, 11-67, 14-85, 15-94, 15-98, 16-102, 16-104, 19-9, 23-37, 25-56
	Manage students	13-79
	See myself as…	6-28, 7-30, 8-35, 13-79, 14-85, 16-104, 19-7
	Responsibility for student	5-21, 7-30, 14-85, 18-5, 19-7, 21-18
Reward (personally)	Lightbulbs	
	Grade success	5-21, 13-79
	Feel Good	5-19, 6-26, 10-56, 14-89, 20-18, 25-56, 27-74
	Proud but humble	6-26, 13-79, 20-15, 25-56, 27-74
	Aspirations or ambitions	6-26, 9-51
	Make a difference	5-21, 6-28, 10-56, 13-79, 20-18, 25-56, 25-59, 27-74
Community	Association with	5-19, 6-24, 9-43, 9-45, 12-77, 13-79, 14-85, 19-7, 20-18, 23-43, 24-48, 25-50, 25-56
	Mentoring by faculty	5-19, 6-28, 7-30, 12-77, 19-7, 23-43, 24-48, 25-56
	Mentoring of Students	5-19, 5-21, 6-28, 7-30, 13-79, 14-85, 20-18, 24-48, 25-56
	Faculty = who and why	5-19, 6-28, 23-43, 24-48, 25-56
Balance	Work	17-111
	School	17-111
	Life Responsibilities	17-111
Self-Regulation	Identify	8-35, 17-111
	Prioritize	8-35, 17-111

Appendix G2 above shows the location of each individual Personal Impact code, by category, within the transcript for Brian. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 5 in box 19 of the analyzed Personal Impact transcript.

Appendix G3 – Summary of Personal Impact Code Locations for Cassandra

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	5-26, 6-42, 7-50, 8-59, 10-71, 10-73, 10-75, 13-99, 14-5, 14-9, 20-34
	Manage students	6-42, 10-71
	See myself as…	5-28, 7-50, 8-59, 8-61, 10-71, 10-75, 13-99, 14-5, 14-9, 17-21, 20-34
	Responsibility for student	6-38, 8-55, 10-71, 18-27, 20-37
Reward	Lightbulbs	
	Grade success	
	Feel Good	7-52, 8-59, 14-3, 14-5, 14-9, 18-21, 20-34
	Proud but humble	7-52, 8-59, 14-3, 14-5, 14-9, 18-21, 19-29, 20-34
	Aspirations or ambitions	4-8, 7-50, 10-75
	Make a difference	7-52
Community	Association with	5-26, 6-42, 21-50, 22-52, 22-54
	Mentoring by faculty	5-26, 22-56
	Mentoring of Students	5-26, 22-56
	Faculty = who and why	5-26, 22-52
Balance	Work	4-10, 4-12, 5-16, 11-80, 12-95
	School	4-12, 11-80, 12-95
	Life	4-10
	Responsibilities	4-10
Self-Regulation	Identify	4-8, 7-50, 13-99, 18-21
	Prioritize	4-8, 7-50, 13-99, 18-21

Appendix G3 above shows the location of each individual Personal Impact code, by category, within the transcript for Cassandra. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 5 in box 26 of the analyzed Personal Impact transcript.

Appendix G4 – Summary of Personal Impact Code Locations for Danielle

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	7-19, 9-33, 10-45, 11-50, 12-53, 14-68, 14-70, 15-72, 15-75, 17-91, 21-119, 27-13, 32-45, 35-60, 36-72, 37-75
	Manage students	
	See myself as…	14-70, 15-72, 16-80, 17-91, 17-91, 18-97, 18-92, 18-101, 20-110, 26-5, 26-7, 26-9, 27-13, 33-49, 35-60, 36-70, 37-75
	Responsibility for student	7-19, 8-29, 9-33, 9-40
Reward	Lightbulbs	17-91, 22-122
	Grade success	22-122
	Feel Good	7-15, 12-62, 17-91, 18-71, 19-103, 19-105, 25-3, 26-7, 35-65, 36-70, 36-72
	Proud but humble	7-15, 7-19, 12-53, 15-75, 17-91, 18-71, 19-105, 21-116, 22-122, 26-7, 33-49, 36-70, 36-72
	Aspirations or ambitions	12-62, 16-80, 25-3
	Make a difference	12-53, 15-72, 20-110, 22-122, 26-7
Community	Association with	8-9, 8-25, 8-29, 10-48, 11-53, 14-68, 18-97, 24-134, 31-32, 34-55, 36-70
	Mentoring by faculty	8-29, 10-45, 10-48, 12-53, 24-134
	Mentoring of Students	10-45, 10-48, 18-91, 36-70
	Faculty = who and why	6-10, 7-15, 10-48, 24-134, 31-32
Balance	Work	19-108, 22-125
	School	19-108, 22-125
	Life	19-108, 22-125
	Responsibilities	19-108, 22-125
Self-Regulation	Identify	24-134, 23-137
	Prioritize	24-134, 23-137

Appendix G4 above shows the location of each individual Personal Impact code, by category, within the transcript for Danielle. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 7 in box 19 of the analyzed Personal Impact transcript.

Appendix G5 – Summary of Personal Impact Code Locations for Emily

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	7-31, 8-37, 9-46, 9-52, 14-93, 14-95, 16-107, 17-121, 19-130, 19-132, 20-134, 21-142, 21-145, 22-148, 34-260, 34-262, 38-268, 41-35, 44-58, 51-132, 55-184, 57-217
	Manage students	14-93, 14-95, 17-121, 19-130, 19-132, 20-134, 21-142, 34-260, 35-268
	See myself as…	7-31, 14-93, 14-95, 17-121, 19-130, 19-132, 20-134, 21-142, 21-145, 22-148, 32-243, 34-262, 41-35, 45-68, 51-129
	Responsibility for student	13-86, 14-93, 14-95, 17-121, 20-134, 22-148, 33-256, 34-256, 34-262, 35-268, 57-209
Reward	Lightbulbs	42-47, 43-56
	Grade success	32-246, 35-271
	Feel Good	8-39, 14-93, 18-124, 30-224, 32-246, 33-251, 35-271, 39-8, 39-17, 46-80, 52-142, 54-158, 54-160, 58-231
	Proud but humble	8-39, 14-93, 18-124, 26-184, 30-224, 32-246, 33-251, 35-271, 39-8, 54-158, 58-231
	Aspirations or ambitions	18-124, 26-184, 32, 241
	Make a difference	30-224, 32-246
Community	Association with	7-27, 7-29, 8-37, 9-48, 9-50, 9-54, 10-58, 10-60, 10-62, 10-64, 11-69, 11-76, 13-86, 14-98, 15-100, 15-104, 16-107, 23-160, 24-166, 31-230, 39-8, 39-17, 40-23, 48-94, 48-102
	Mentoring by faculty	7-27, 7-29, 8-37, 9-54, 11-76, 12-82, 16-107, 23-160, 24-166, 25-168, 39-8, 40-23
	Mentoring of Students	11-76, 12-82, 25-168, 26-187, 48-94
	Faculty = who and why	7-27, 7-29, 8-37, 11-69, 11-76, 16-107, 23-155, 23-160, 24-166, 31-230, 23-246, 39-8, 55-182, 60-251
Balance	Work	5-13, 12-82, 36-274
	School	5-13, 12-82, 36-274, 46-80
	Life	
	Responsibilities	5-13, 12-82, 12-84, 36-274, 37-276, 46-80
Self-Regulation	Identify	6-13, 7-27, 7-29, 7-31, 8-37, 16-107, 17-113, 25-172, 42-47, 46-80, 47-87
	Prioritize	7-27, 7-29, 7-31, 8-37, 16-107, 17-113, 25-172, 42-47, 46-80, 47-87

Appendix G5 above shows the location of each individual Personal Impact code, by category, within the transcript for Emily. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 7 in box 31 of the analyzed Personal Impact transcript.

Appendix G6 – Summary of Personal Impact Code Locations for Faith

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	7-54, 8-67, 9-77, 12-103, 12-105, 15-134, 15-136, 17-147, 17-149, 17-152, 19-164, 19-167, 21-186, 22-193, 25-236, 30-24, 33-55, 41-118
	Manage students	7-63, 12-103, 19-164, 28-6, 30-28, 30-30
	See myself as…	7-53, 7-61, 12-103, 17-12, 21-186, 30-26, 35-68, 41-118
	Responsibility for student	20-167, 19-160, 19-165, 20-167, 26-243, 37-75
Reward	Lightbulbs	20-167, 25-231, 30-21
	Grade success	20-167, 20-172, 30-21
	Feel Good	7-58, 9-77, 15-134, 16-140, 20-167, 20-172, 20-174, 20-181, 20-183, 25-231, 25-231, 29-17, 30-21, 34-57
	Proud but humble	6-50, 7-56, 7-63, 12-111, 20-167, 20-181, 20-183, 21-186, 22-193, 25-231, 29-17, 30-21, 34-57
	Aspirations or ambitions	15-136, 19-164
	Make a difference	16-136, 18-160, 20-172, 25-231, 30-21, 37-75
Community	Association with	5-21, 5-23, 5-30, 7-61, 9-77, 9-83, 9-85, 10-87, 10-91, 10-94, 11-96, 11-98, 13-121, 14-123, 18-160, 19-160, 35-68, 36-72
	Mentoring by faculty	7-61, 9-77, 10-91, 13-121, 14-123, 14-127, 22-19535-68
	Mentoring of Students	7-6, 10-91, 19-160, 13-21, 14-127, 22-195, 35-68
	Faculty = who and why	4-9, 7-61, 9-77, 11-103, 13-121, 14-123, 14-127, 14-131, 21-186, 22-195, 25-236, 35-68
Balance	Work	8-63, 15-136, 21-186
	School	8-63, 15-136, 21-186, 26, -241
	Life	15-136, 26-241
	Responsibilities	8-63, 15-136, 23-204, 26-241
Self-Regulation	Identify	7-54, 10-91, 11-100, 12-105, 15-136, 17-142, 19-164, 38-81
	Prioritize	7-54, 11-100, 12-105, 15-136, 17-142, 19-164, 38-81

Appendix G6 above shows the location of each individual Personal Impact code, by category, within the transcript for Faith. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 7in box 54 of the analyzed Personal Impact transcript.

Appendix G7– Summary of Personal Impact Code Locations for George

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	6-29, 7-33, 11-65, 17-22, 18-31, 18-37, 22-46, 23-55, 24-59, 25-71, 28-85, 29-91, 31-105, 35-6, 35-8, 41-37
	Manage students	
	See myself as…	6-29, 7-33, 9-54, 10-60, 11-65, 15-17, 16-20, 17-22, 18-31, 18-37, 25-71, 26-78, 27-82, 28-85, 31-105, 53-98
	Responsibility for student	23-55, 25-71, 27-82, 29-91, 34-116, 41-48
Reward	Lightbulbs	
	Grade success	
	Feel Good	25-71, 30-94, 33-110, 42-48
	Proud but humble	18-37, 25-71, 30-94, 33-110, 42-48
	Aspirations or ambitions	9-56, 15-17, 17-25, 37-16, 41-40
	Make a difference	25-71, 30-94, 33-110, 34-116, 42-48
Community	Association with	1-4, 6-29, 11-65, 17-22, 17-29, 18-34, 18-37, 23-53, 30-94, 31-100, 34-116, 41-40, 52-98
	Mentoring by faculty	11-65, 17-22, 18-34, 18-37, 30-94, 31-100, 41-40, 52-98
	Mentoring of Students	30-91, 31-100
	Faculty = who and why	17-22, 17-29, 18-34, 18-37, 30-94, 31-100, 41-40, 52-98
Balance	Work	33-113
	School	33-113
	Life	
	Responsibilities	33-113
Self-Regulation	Identify	7-33, 15-17, 18-37, 26-74, 33-113
	Prioritize	7-33, 15-17, 18-37, 26-74, 33-113

Appendix G7 above shows the location of each individual Personal Impact code, by category, within the transcript for George. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 6 in box 29 of the analyzed Personal Impact transcript.

Appendix G8 – Summary of Personal Impact Code Locations for Heather

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	7-53, 8-56, 8-60, 8-63, 10-82, 11-85, 14-14, 15-20, 16-23, 16-27, 17-39, 17-41, 18-45, 18-52, 19-54, 19-58, 19-61
	Manage students	
	See myself as…	11-85, 15-20, 16-23, 16-25, 16-27, 19-54, 19-58, 19-61
	Responsibility for student	10-82, 12-99, 15-20, 16-23, 19-54, 21-81
Reward	Lightbulbs	15-20
	Grade success	15-20
	Feel Good	10-73, 10-75, 11-85, 15-20, 19-54
	Proud but humble	9-63, 10-73, 10-82, 11-85, 12-99, 14-12, 15-20, 19-54, 21-75, 23-106
	Aspirations or ambitions	7-45, 7-51, 14-14, 19-54
	Make a difference	9-63, 15-16, 15-20, 19-54
Community	Association with	2-17, 4-23, 4-25, 6-24, 6-39, 9-63, 9-67, 14-16, 16-25, 16-27, 20-61, 21-84
	Mentoring by faculty	2-17, 6-24, 16-27
	Mentoring of Students	6-24, 9-63, 16-25, 16-27, 20-61
	Faculty = who and why	2-17, 6-24, 22-90
Balance	Work	6-42, 12-102
	School	6-42, 11-88, 11-90, 12-102
	Life	
	Responsibilities	11-88, 11-90, 12-102
Self-Regulation	Identify	4-15, 4-20, 5-29, 11-90, 12-102, 21-81
	Prioritize	4-15, 4-20, 5-29, 11-90, 12-102, 21-81

Appendix G8 above shows the location of each individual Personal Impact code, by category, within the transcript for Heather. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 7 in box 53 of the analyzed Personal Impact transcript.

Appendix G9 – Summary of Personal Impact Code Locations for Julia

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	8-37, 10-69, 11-74, 12-93, 12-97, 13-107, 14-125, 16-147, 17-161, 18-170, 19-177, 20-188, 20-190, 20-192, 24-240, 30-307, 37-76, 37-82
	Manage students	12-93, 28-285, 28-289
	See myself as…	8-37, 9-57, 14-125, 17-161, 37-82
	Responsibility for student	8-37, 38-92, 39-98, 39-102
Reward	Lightbulbs	20-190
	Grade success	20-190, 22-210
	Feel Good	7-25, 8-32, 11-72, 13-99, 18-165, 20-190, 22-210, 27-272, 30-3, 32-5, 34-35, 37-82
	Proud but humble	11-72, 13-99, 18-165, 20-190, 34-35
	Aspirations or ambitions	7-25, 12-93, 17-161, 25-248
	Make a difference	20-190, 22-210, 35-47, 38-92
Community	Association with	8-37, 9-39, 9-55, 14-125, 16-149, 16-151, 17-153, 17-158, 20-190, 22-210, 23-219, 25-248, 26-261, 30-297, 32-3, 38-86, 38-88, 39-95
	Mentoring by faculty	16-145, 16-147, 16-151, 23-219, 25-248
	Mentoring of Students	9-39, 16-151, 23-219, 25-248, 32-3, 38-86
	Faculty = who and why	7-23, 10-63, 10-65, 10-69, 16-145, 23-219
Balance	Work	7-20, 7-25, 18-161, 26-266, 27-268, 28-279, 30-304
	School	7-20, 7-25, 26-264, 26-266, 28-279, 30-304
	Life	7-20, 18-161
	Responsibilities	7-25, 27-268, 39-95
Self-Regulation	Identify	18-165, 19-175, 27-268, 27-275, 30-304, 39-95
	Prioritize	18-165, 27-268, 27-275, 30-304, 39-95

Appendix G9 above shows the location of each individual Personal Impact code, by category, within the transcript for Julia. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 7 in box 37 of the analyzed Personal Impact transcript.

Appendix G10– Summary of Personal Impact Code Locations for Kevin

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	10-47, 13-74, 14-87, 15-93, 19-3, 19-5, 20-7, 22-20a, 22-20b, 24-31, 25-36, 28-62, 29-62, 30-76, 32-80, 33-94
	Manage students	11-54, 13-74, 15-97, 15-93, 16-105
	See myself as…	6-10, 9-35, 9-37, 10-47, 11-66, 15-93, 21-13
	Responsibility for student	10-47, 15-99, 15-93, 24-27, 30-76
Reward	Lightbulbs	12-71, 13-81, 17-117, 18-117
	Grade success	23-25
	Feel Good	6-10, 6-17, 8-29, 9-37, 10-47, 12-71, 13-81, 14-87, 16-105, 28-62
	Proud but humble	10-47, 12-71, 16-105, 27-51
	Aspirations or ambitions	10-43
	Make a difference	6-10, 10-48, 14-82, 14-88, 22-20, 23-23, 24-27, 25-34, 28-62
Community	Association with	6-10, 7-23, 8-29, 12-71, 20-7, 20-9, 22-20
	Mentoring by faculty	6-10, 12-71, 13-74
	Mentoring of Students	6-10, 10-47, 20-7
	Faculty = who and why	6-17, 11-64, 12-71
Balance	Work	
	School	18-123
	Life	
	Responsibilities	18-123
Self-Regulation	Identify	20-7, 28-62
	Prioritize	20-7, 28, 62

Appendix G10 above shows the location of each individual Personal Impact code, by category, within the transcript for Kevin. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 10 in box 47 of the analyzed Personal Impact transcript.

Appendix G11 – Summary of Personal Impact Code Locations for Lisa

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	5-17, 5-22, 7-30, 8-38, 9-42, 10-53, 11-58, 11-62, 12-66, 12-69, 13-75, 13-79, 14-81, 14-83, 15-89, 15-92, 16-94, 16-96, 17-101, 18-108, 23-6
	Manage students	7-30, 8-38, 9-42, 10-53, 13-77, 17-104, 20-124, 26-36
	See myself as…	4-3, 5-22, 7-30, 8-36, 8-38, 9-42, 10-53, 11-58, 11-62, 12-62, 12-66, 13-69, 16-92, 23-6, 24-21, 27-43, 27-46
	Responsibility for student	7-28, 9-42, 10-48, 10-50, 10-53, 12-66, 21-126
Reward	Lightbulbs	29-63
	Grade success	
	Feel Good	4-11, 5-22, 7-30, 27-51
	Proud but humble	4-11, 5-22, 6-23, 7-30, 10-50, 27-51
	Aspirations or ambitions	6-22, 6-23, 7-30, 13-69, 24-17, 27-51, 30-73, 30-75
	Make a difference	6-25, 6-28, 10-50
Community	Association with	4-11, 5-13, 6-23, 6-28, 7-30, 7-34, 8-36, 8-42, 9-45, 9-48, 10-50, 10-53, 14-89, 19-89, 18-111, 22-3, 24-21, 30-73, 31-82
	Mentoring by faculty	6-23, 7-30, 8-42, 10-50, 17-104, 18-111, 23-6, 24-21, 30-73, 31-82
	Mentoring of Students	6-23, 7-30, 8-42, 10-50, 10-53, 17-104, 18-111, 23-6, 24-21, 30-73, 31-82
	Faculty = who and why	6-23, 6-25, 6-28, 7-30, 8-42, 9-48, 10-50, 18-111, 30-73, 31-82
Balance	Work	19-116
	School	5-17, 15-89, 19-116
	Life	
	Responsibilities	15-89, 19-116, 19-119
Self-Regulation	Identify	5-17, 19-119
	Prioritize	5-17, 19-119

Appendix G11 above shows the location of each individual Personal Impact code, by category, within the transcript for Lisa. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 5 in box 17 of the analyzed Personal Impact transcript.

Appendix G12 – Summary of Personal Impact Code Locations for Mabel

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	5-26, 5-28, 10-77, 11-86, 11-88, 13-92, 13-99, 14-104, 16-118, 17-122**, 18-130, 20-138, 21-151, 24-170, 25-3, 26-14, 27-17, 29-28
	Manage students	5-28, 16-118, 20-138, 30-35
	See myself as…	5-28, 6-40, 8-57, 9-63, 10-77, 11-86, 13-99, 14-102, 14-104, 15-112, 16-118, 17-122, 18-127, 20-138, 21-151, 25-3, 29-30, 30-35, 33-60
	Responsibility for student	5-28, 9-63, 10-77, 11-86, 12-92, 14-104, 15-112, 22-157, 22-159
Reward	Lightbulbs	5-26, 5-28, 10-77, 11-86, 12-90, 19-133, 20-144, 21-154
	Grade success	
	Feel Good	4-22, 9-63, 9-65, 9-75, 10-77, 11-88, 12-90, 13-92, 15-110, 20-144, 28-25
	Proud but humble	4-24, 9-63, 9-75, 10-77, 12-90, 15-110, 16-116, 20-138, 20-144, 21-154, 27-20, 28-25
	Aspirations or ambitions	4-22, 4-24, 9-75, 16-116, 27-20
	Make a difference	12-90, 13-92, 15-112, 16-116, 20-138, 28-25
Community	Association with	6-40, 7-47, 9-63
	Mentoring by faculty	7-47
	Mentoring of Students	7-47, 9-34, 9-65, 22-161
	Faculty = who and why	
Balance	Work	23-164
	School	23-164
	Life	
	Responsibilities	23-164
Self-Regulation	Identify	10-77, 22-159, 29-33,
	Prioritize	10-77, 22-159, 29-33,

Appendix G12 above shows the location of each individual Personal Impact code, by category, within the transcript for Mabel. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 5 in box 26 of the analyzed Personal Impact transcript.

Appendix G13 – Summary of Personal Impact Code Locations for Noah

Categories	Codes	Location of Personal Impact Codes in Analyzed Transcript by Page and Box Number
Self Confidence	I can do it	9-60, 9-62, 12-77, 13-79, 13-81, 14-88, 15-97, 16-102, 17-108, 17-120, 24-164, 29-10, 32-21, 34-33, 40-58
	Manage students	9-60, 15-97, 17-120,
	See myself as…	12-77, 13-78, 13-81, 14-88, 15-97, 16-102, 24-164, 29-10, 31-14, 32-21, 3433,
	Responsibility for student	9-60, 19-120, 33-26
Reward	Lightbulbs	
	Grade success	
	Feel Good	34-33
	Proud but humble	5-31, 16-104, 33-26, 34-33, 41-58
	Aspirations or ambitions	14-90, 17-108
	Make a difference	19-120, 33-26, 34-33, 41-58
Community	Association with	5-33, 6-37, 9-58, 13-83, 14-88, 20-133, 22-148, 22-152, 25-16
	Mentoring by faculty	5-33, 5-35, 7-43, 7-45
	Mentoring of Students	20-133
	Faculty = who and why	5-33, 5-35, 6-37, 22-148, 22-152
Balance	Work	5-33, 15-97, 25-176, 27-196, 27-198
	School	5-33, 15-97, 25-176, 27-196, 27-198
	Life	
	Responsibilities	15-97, 25-176, 27-196
Self-Regulation	Identify	12-77, 14-92, 27-196
	Prioritize	12-77, 14-92, 27-196

Appendix G13 above shows the location of each individual Personal Impact code, by category, within the transcript for Noah. Information can be interpreted as page-box number. For example, in the "Self Confidence" category, the code "I can do it" appears first on page 9 in box 60 of the analyzed Personal Impact transcript.

Appendix H
Summarized Location and Frequency of Professional Impact Codes by Participants

Appendix H1 – Summary of Personal Impact Code Locations for Adam

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	**note, was already accepted to grad school when this TA experience happened
	Stand out	
	Resume/CV	
	Review Material	7-42, 7-45, 18-4
	Proffessional Characteristics	4-12, 4-14, 5-21, 5-27, 7-41, 8-58, 9-60, 10-72, 12-80, 14-98, 15-109, 17-122, 18-4, 19-6, 23-35, 24-42, 25-55
	Ready for next step	4-14, 5-21, 8-58, 10-72, 15-109, 18-4, 19-6, 23-35
Experience	Highly Impactful Event	9-60, 9-62, 10-72, 11-78, 13-91, 17-122, 22-33
	Skill Acquisition	7-45, 9-60, 12-85, 23-38
	Knowledge Development	7-45, 9-60, 12-85, 23-38
	Think on feet	7-41, 9-60, 12-88, 23-38
	Adaptability	7-41, 9-60, 10-72, 12-88, 14-101, 23-38
	Communication/Dialogue	8-47, 9-60 , 10-72, 11-78, 23-35, 25-62
Career Exploration	Testing the waters	4-12, 4-14, 5-21, 5-27, 9-58, 9-60, 17-122, 19-11
	Modeling Faculty	6-36, 6-38, 13-88, 15-103, 16-117, 21-22, 24-55
	Peer Comparison	16-117, 25-55
Value Compared to Research	Did Undergrad Research	9-62
	Didn't Do Undergrad Research	

Appendix H1 above shows the location of each individual Professional Impact code, by category, within the transcript for Adam. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Review Material” appears first on page 7 in box 42 of the analyzed Professional Impact transcript.

Appendix H2– Summary of Personal Impact Code Locations for Brian

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	20-15
	Stand out	5-19, 7-33
	Resume/CV	5-19, 10-56
	Review Material	7-33, 8-41
	Proffessional Characteristics	5-19, 6-28, 9-51, 10-56, 10-58, 14-85, 14-89, 16-103, 19-7, 22-33
	Ready for next step	8-41, 10-56, 16-102
Experience	Highly Impactful Event	7-33, 10-56, 13-79, 23-37
	Skill Acquisition	10-56, 14-85, 21-24, 25-59
	Knowledge Development	7-33, 11-64, 16-104, 21-24, 25-59
	Think on feet	14-85, 16-104, 25-59
	Adaptability	7-30, 14-85, 17-111, 25-59
	Communication/Dialogue	7-30, 14-85, 16-104, 25-59
Career Exploration	Testing the waters	16-102
	Modeling Faculty	6-26, 6-28, 7-33, 24-48, 25-56
	Peer Comparison	8-35, 19-9, 25-52
Value Compared to Research	Did Undergrad Research	
	Didn't Do Undergrad Research	16-102

Appendix H2 above shows the location of each individual Professional Impact code, by category, within the transcript for Brian. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Interview” appears on page 20 in box 15 of the analyzed Professional Impact transcript.

Appendix H3 – Summary of Personal Impact Code Locations for Cassandra

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	10-71
	Stand out	4-8, 8-59, 10-73, 10-75, 14-3, 14-9
	Resume/CV	4-8, 14-3, 16-9
	Review Material	8-55
	Proffessional Characteristics	4-6, 6-42, 7-50, 8-59, 8-61, 10-75, 13-99, 14-5, 14-9, 18-27, 20-34
	Ready for next step	7-50, 10-75, 13-99, 14-5, 14-9
Experience	Highly Impactful Event	7-52, 10-71, 14-5, 14-9
	Skill Acquisition	6-38, 7-50, 8-59, 19-27
	Knowledge Development	5-26, 8-59
	Think on feet	9-65
	Adaptability	9-65
	Communication/Dialogue	7-50, 22-56
Career Exploration	Testing the waters	17-21, 18-22
	Modeling Faculty	5-26
	Peer Comparison	8-59, 13-99, 14-9, 20-34
Value Compared to Research	Did Undergrad Research	14-5, 14-9
	Didn't Do Undergrad Research	

Appendix H3 above shows the location of each individual Professional Impact code, by category, within the transcript for Cassandra. Information can be interpreted as page-box number. For example, in the "Development" category, the code "Interview" appears on page 10 in box 71 of the analyzed Professional Impact transcript.

Appendix H4 – Summary of Personal Impact Code Locations for Danielle

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	25-3
	Stand out	16-180, 21-116
	Resume/CV	25-3
	Review Material	15-77
	Proffessional Characteristics	7-15, 10-45, 11-53, 12-55, 12-60, 12-62, 14-68, 14-70, 15-72, 21-116, 27-13, 28-24, 32-45, 33-49, 36-70
	Ready for next step	7-19, 11-60, 12-62, 14-70, 15-72, 17-91, 21-116, 21-119, 27-13, 36-70
Experience	Highly Impactful Event	12-62, 17-91, 18-91, 19-105, 22-122, 35-60
	Skill Acquisition	11-50, 15-75, 17-91, 23-125
	Knowledge Development	11-50, 14-68, 15-75, 17-91
	Think on feet	29-26, 31-32, 32-45
	Adaptability	9-33, 17-87, 18-97, 29-26
	Communication/Dialogue	9-33, 9-40, 10-45, 15-72, 16-83, 16-85, 17-91, 20-110
Career Exploration	Testing the waters	16-80, 26-7
	Modeling Faculty	8-29, 10-48, 17-91
	Peer Comparison	18-97
Value Compared to Research	Did Undergrad Research	No discussion
	Didn't Do Undergrad Research	No discussion

Appendix H4 above shows the location of each individual Professional Impact code, by category, within the transcript for Danielle. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Interview” appears on page 25 in box 3 of the analyzed Professional Impact transcript.

Appendix H5 – Summary of Personal Impact Code Locations for Emily

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	18-124, 38-4
	Stand out	6-27, 8-37, 18-124, 22-148
	Resume/CV	6-27, 18-124, 22-148
	Review Material	8-37, 8-41, 9-46, 11-76, 14-98, 15-100, 38-4, 39-8, 45-68, 46-80, 47-85, 54-160
	Proffessional Characteristics	5-13, 7-29, 8-37, 14-98, 16-107, 18-124, 21-142, 21-145, 26-184, 32-241, 32-243, 33-251, 37-276, 38-4, 41-35, 43-56
	Ready for next step	18-124, 19-132, 20-134, 21-145, 32-243, 41-35, 43-56
Experience	Highly Impactful Event	6-27, 7-27, 7-29, 7-31, 8-37, 16-107, 18-121, 18-124, 23-155, 36-274, 42-47, 51-129
	Skill Acquisition	14-93, 18-121, 33-256, 40-23, 45-68
	Knowledge Development	11-76, 8-41, 15-98, 15-100, 18-121, 45-68
	Think on feet	14-93, 33-256, 34-260, 34-262, 35-268, 52-142
	Adaptability	14-93, 15-100, 18-124, 22-148, 33-256, 34-260, 34-262, 35-268, 52-142
	Communication/Dialogue	14-95, 20-134, 22-148, 33-256, 34-258, 44-58, 52-142, 55-184
Career Exploration	Testing the waters	6-27, 7-29, 7-31, 9-52, 16-107, 17-121, 18-124, 19-130, 21-142, 21-145
	Modeling Faculty	9-50, 9-52, 10-60, 10-64, 19-130, 26-187, 31-232, 34,-258, 51-132
	Peer Comparison	10-60, 10-64, 13-86, 14-98, 24-258, 45-68, 45-71, 48-102
Value Compared to Research	Did Undergrad Research	
	Didn't Do Undergrad Research	7-29, 7-31

Appendix H5 above shows the location of each individual Professional Impact code, by category, within the transcript for Emily. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Interview” appears first on page 18 in box 124 of the analyzed Professional Impact transcript.

Appendix H6 – Summary of Personal Impact Code Locations for Faith

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	
	Stand out	8-63, 21-186, 23-197
	Resume/CV	
	Review Material	12-109, 13-114, 13-116, 14-127, 14-129, 14-131, 17-149, 30-24
	Proffessional Characteristics	13-114, 21-186, 22-193, 22-195, 23-197, 24-226, 29-13, 30-24
	Ready for next step	7-54, 8-63, 19-164, 21-186, 23-197, 24-226, 30-24
Experience	Highly Impactful Event	8-67, 13-114, 17-147, 17-149, 19-164, 21-186, 22-193, 30-24, 31-39, 33-49, 34-57
	Skill Acquisition	8-67, 12-109, 17-147, 17-149, 19-164, 28-6, 30-24, 31-39, 34-57
	Knowledge Development	8-67, 12-109, 17-147, 17-149, 19-164, 30-24, 31-39, 32-41, 34-57
	Think on feet	18-160, 19-164, 28-6, 31-39, 41-139, 43-136
	Adaptability	15-134, 15-136, 18-160, 19-164, 23-197, 28-6, 41-139, 32-41, 32-44, 43-136
	Communication/Dialogue	14-121, 19-164, 20-167, 30-24, 31-39, 32-41, 32-44
Career Exploration	Testing the waters	6-42, 6-44, 6-46, 6-48, 6-50, 7-61, 16-140, , 17-152, 21-186, 23-197, 25-236
	Modeling Faculty	7-63, 10-91, 17-153
	Peer Comparison	13-121, 18-160, 19-164, 23-197, 35-178, 36-75
Value Compared to Research	Did Undergrad Research	8-67, 9-69, 25-236, 28-6
	Didn't Do Undergrad Research	

Appendix H6 above shows the location of each individual Professional Impact code, by category, within the transcript for Faith. Information can be interpreted as page-box number. For example, in the "Development" category, the code "Stand out" appears first on page 8 in box 63 of the analyzed Professional Impact transcript.

Appendix H7 – Summary of Personal Impact Code Locations for George

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	35-4
	Stand out	6-29, 35-6
	Resume/CV	7-33, 36-12, 37-16
	Review Material	8-44, 25-71, 28-57
	Proffessional Characteristics	10-60, 11-65, 18-31, 18-34, 18-37, 23-55, 25-71, 28-85, 29-91, 30-94, 32-107, 33-113, 41-37, 41-40, 52-98
	Ready for next step	6-29, 25-71, 28-85, 30-94, 35-4, 35-6, 35-8, 41-40
Experience	Highly Impactful Event	11-65, 15-17, 17-22, 18-34, 26-66, 25-71, 30-94, 33-110, 42-48
	Skill Acquisition	27-82, 43-55
	Knowledge Development	25-71, 26-74, 26-78, 27-82, 43-55
	Think on feet	27-82
	Adaptability	27-82
	Communication/Dialogue	31-100
Career Exploration	Testing the waters	9-54, 11-65, 15-17, 16-20, 17-22, 24-59, 25-66, 25-71, 30-94, 31-105, 41-37
	Modeling Faculty	11-65, 16-20, 17-22, 41-40
	Peer Comparison	3-11, 18-31, 23-55, 35-6
Value Compared to Research	Did Undergrad Research	20-41, 22-46
	Didn't Do Undergrad Research	

Appendix H7 above shows the location of each individual Professional Impact code, by category, within the transcript for George. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Interview” appears on page 35 in box 4 of the analyzed Professional Impact transcript.

Appendix H8 – Summary of Personal Impact Code Locations for Heather

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	10-77, 10-80, 12-99, 14-6, 14-14
	Stand out	14-16, 19-54
	Resume/CV	4-15, 7-45
	Review Material	16-23, 20-67, 21-81
	Proffessional Characteristics	5-25, 5-29, 7-45, 8-56, 8-60, 107, 14-12, 18-45, 18-47, 18-52, 19-54, 19-58
	Ready for next step	14-12, 16-23, 17-41, 18-45, 18-52, 19-54, 19-58
Experience	Highly Impactful Event	4-15, 7-45, 7-53, 9-63, 10-73, 10-77, 10-82, 14-16, 15-20, 18-52, 19-54, 19-58
	Skill Acquisition	6-34, 7-45, 16-27, 18-52, 19-54, 20-67
	Knowledge Development	6-34, 7-45, 16-27, 18-52, 19-54, 20-67
	Think on feet	9-63, 16-27, 18-52, 19-54
	Adaptability	8-56, 8-60, 9-63, 9-67, 12-102, 16-27, 18-52, 19-54
	Communication/Dialogue	6-34, 7-45, 8-60, 15-20, 16-25, 16-27, 18-52, 19-54, 19-61, 20-63
Career Exploration	Testing the waters	4-7, 4-9, 5-20, 5-29, 6-42, 7-45, 17-35, 17-39, 17-41, 18-45
	Modeling Faculty	7-45, 19-54, 22-90
	Peer Comparison	21-84
Value Compared to Research	Did Undergrad Research	5-27, 5-29
	Didn't Do Undergrad Research	

Appendix H8 above shows the location of each individual Professional Impact code, by category, within the transcript for Heather. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Interview” appears first on page 10 in box 77 of the analyzed Professional Impact transcript.

Appendix H9 – Summary of Personal Impact Code Locations for Julia

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	
	Stand out	25-248
	Resume/CV	7-25, 11-74, 25-248
	Review Material	16-151, 1, 7-153, 27-272, 27-275, 39-102
	Proffessional Characteristics	7-25, 8-37, 9-57, 12-93, 13-107, 13-109, 24-238, 24-240, 28-285, 30-307, 33-12, 34-35, 37-82, 40-113
	Ready for next step	12-93, 13-109, 17-161, 25-248, 33-12, 34-35
Experience	Highly Impactful Event	7-25, 11-72, 12-97, 18-161, 18-170, 24-240, 28-285, 34-40, 35-47, 37-82
	Skill Acquisition	12-93, 12-97, 20-192, 28-285
	Knowledge Development	20-192, 39-102
	Think on feet	39-102
	Adaptability	12-93, 23-219, 24-238, 26-264, 28-285, 39-102
	Communication/Dialogue	16-145, 24-238, 28-281, 28-285, 39-102
Career Exploration	Testing the waters	8-37, 12-93, 13-111, 18-165, 19-175, 21-202
	Modeling Faculty	12-97, 19-175, 20-190
	Peer Comparison	14-125, 20-188, 25-248, 30-299
Value Compared to Research	Did Undergrad Research	11-80, 12-91, 12-95, 13-99
	Didn't Do Undergrad Research	

Appendix H9 above shows the location of each individual Professional Impact code, by category, within the transcript for Julia. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Stand out” appears on page 25 in box 248 of the analyzed Professional Impact transcript.

Appendix H10 – Summary of Personal Impact Code Locations for Kevin

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	16-106, 22-20
	Stand out	5-10, 10-44, 22-20, 22-20
	Resume/CV	5-10, 16-106, 22-20
	Review Material	17-110, 24-27, 29-62
	Proffessional Characteristics	11-67, 12-71, 13-75, 20-7, 21-15, 23-23, 25-34, 25-36
	Ready for next step	5-3, 10-48, 16-106, 20-7, 25-34, 25-36, 29-62
Experience	Highly Impactful Event	6-10, 10-48, 12-72, 14-88, 25-36, 26-40, 27-51, 27-57, 28-62
	Skill Acquisition	10-48, 11-55, 11-67, 12-71, 21-15, 29-62
	Knowledge Development	7-23, 15-100, 17-110, 21-15, 29-62
	Think on feet	11-67, 29-62
	Adaptability	12-72, 18-118
	Communication/Dialogue	9-38, 11-67, 12-67, 12-72, 13-75, 18-118, 29-62
Career Exploration	Testing the waters	13-75, 18-124, 21-13, 23-23, 29-62
	Modeling Faculty	6-17, 7-21, 9-33, 9-35, 14-85, 18-124, 23-23
	Peer Comparison	7-23
Value Compared to Research	Did Undergrad Research	11-55, 11-65
	Didn't Do Undergrad Research	

Appendix H10 above shows the location of each individual Professional Impact code, by category, within the transcript for Kevin. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Interview” appears first on page 16 in box 106 of the analyzed Professional Impact transcript.

Appendix H11 – Summary of Personal Impact Code Locations for Lisa

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	23-6
	Stand out	6-23, 27-51
	Resume/CV	5-22, 28-55
	Review Material	9-48, 10-53, 13-79, 14-83, 29-63, 29-65, 31-82
	Proffessional Characteristics	4-3, 6-22, 7-30, 8-38, 9-45, 11-62, 12-66, 13-79, 15-92, 17-101, 17-104, 18-111, 19-119, 21-126, 22-3, 23-11, 24-17, 26-36
	Ready for next step	5-17, 7-30, 11-62, 12-66, 13-79, 18-108, 22-3, 27-46, 31-82
Experience	Highly Impactful Event	4-3, 5-22, 7-30, 9-42, 10-50, 12-62, 12-66, 13-69, 14-89, 15-89, 27-51, 28-59, 30-73
	Skill Acquisition	6-28, 10-48, 10-53, 16-94, 16-96
	Knowledge Development	7-30, 10-48, 10-53
	Think on feet	7-28, 9-42, 10-48, 13-75, 13-77
	Adaptability	6-28, 9-42, 10-48, 13-75, 19-116
	Communication/Dialogue	7-28, 7-30, 10-48, 10-50, 10-53
Career Exploration	Testing the waters	4-3, 9-42, 11-58, 13-69, 24-21
	Modeling Faculty	4-3, 6-28, 7-30, 9-42, 10-50, 14-89, 17-101, 22-3, 23-6, 26-43
	Peer Comparison	4-11, 7-34, 10-53, 12-66, 17-98
Value Compared to Research	Did Undergrad Research	
	Didn't Do Undergrad Research	23-13, 23-15, 24-17

Appendix H11 above shows the location of each individual Professional Impact code, by category, within the transcript for Lisa. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Interview” appears on page 23 in box 6 of the analyzed Professional Impact transcript.

Appendix H12 – Summary of Personal Impact Code Locations for Mabel

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	
	Stand out	26-8
	Resume/CV	
	Review Material	5-24, 5-26, 7-49, 11-86, 13-99, 26-14
	Proffessional Characteristics	3-3, 4-22, 7-47, 9-65, 10-77, 14-104, 15-112, 16-116, 18-127, 26-8, 27-20, 28-25, 29-30, 29-33, 32-57
	Ready for next step	10-77, 14-104, 15-112, 26-8
Experience	Highly Impactful Event	10-77, 12-90, 13-99, 17-122, 19-133, 21-154, 29-33
	Skill Acquisition	4-22, 4-24, 12-92, 15-112, 22-157, 29-28, 29-30
	Knowledge Development	4-22, 4-24, 11-86
	Think on feet	16-118
	Adaptability	11-86, 11-88, 15-112, 16-118, 18-130, 20-138
	Communication/Dialogue	5-34, 11-88, 12-92, 15-112, 18-130
Career Exploration	Testing the waters	4-22, 8-57, 8-63, 13-99, 14-102, 18-127, 19-133, 20-144, 21-151, 25-3, 28-25
	Modeling Faculty	4-24, 20-138, 33-60
	Peer Comparison	16-116, 30-35
Value Compared to Research	Did Undergrad Research	8-75, 9-63, 9-67, 9-71, 9-75, 10-77, 10-81
	Didn't Do Undergrad Research	

Appendix H12 above shows the location of each individual Professional Impact code, by category, within the transcript for Mabel. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Stand out” appears on page 26 in box 8 of the analyzed Professional Impact transcript.

Appendix H13 – Summary of Personal Impact Code Locations for Noah

Categories	Codes	Location of Professional Impact Codes in Analyzed Transcript by Page and Box Number
Development	Interview	14-88, 14-90, 28-6
	Stand out	8-49, 88-17, 14-90, 14-92, 24-160
	Resume/CV	88-14, 14-90, 14-92, 22-152, 22-154
	Review Material	
	Proffessional Characteristics	13-83, 88-14, 14-90, 14-92, 16-102, 16-104, 17-108, 17-120, 22-148, 24-160, 27-196, 29-10, 31-14, 32-21, 33-26, 34-33
	Ready for next step	13-83, 88-14, 14-90, 14-92, 16-102, 16-104, 17-108, 29-10, 31-14, 33-26, 34-33
Experience	Highly Impactful Event	17-108, 25-169, 33-26, 34-33
	Skill Acquisition	9-60, 9-62, 17-120, 30-14, 34-33
	Knowledge Development	9-60, 9-62, 30-14, 34-33
	Think on feet	24-164, 30-14, 34-33, 40-58
	Adaptability	17-120, 24-164, 30-14, 34-33, 40-58
	Communication/Dialogue	17-120, 23-158, 24-164, 30-14, 34-33, 40-58
Career Exploration	Testing the waters	16-102, 16-104
	Modeling Faculty	16-102, 16-104
	Peer Comparison	12-77, 20-133, 21-138, 24-160, 36-43
Value Compared to Research	Did Undergrad Research	7-43, 8-49, 8-51, 28-6
	Didn't Do Undergrad Research	

Appendix H13 above shows the location of each individual Professional Impact code, by category, within the transcript for Noah. Information can be interpreted as page-box number. For example, in the “Development” category, the code “Interview” appears first on page 14 in box 88 of the analyzed Professional Impact transcript.

Appendix I
Summarized Location and Frequency of Finance Codes by Participants

Appendix I – Summary of Financial Code Locations for All Participants

		Participant examples											
		Adam	Brian	Cassandra	Danielle	Emily	Faith	George	Heather	Julia	Kevin	Lisa	Mabel	Noah
Categories	Code													
	Credit vs Pay		5 22	21-42, 21-44		6-27, 33-251			11-88	7-25		28-55		26-188
	Not the motivation	5-23			43-57	6-27, 33-251	37-88	44-65	11-88		22-20	5-22, 18-111	26-8	6-37, 12-77
Monetary Reward														
	Why I did it								12-95					
	You could have kept it				43-62			43-57						
	Pay was nice but…	5-23	5 22			33-251	37-88	44-65	9-70, 11-88			28-55		26-180

Appendix I above shows the location of each individual Financial code within the transcript of each participant. Information can be interpreted as page-box number. For example, on page 5 in box 23 of Adam's transcript, he provided an explanation of how money or pay was not the primary motivation for why he chose to work as an UTA.

Appendix J
Summarized Location and Frequency of Concerns Not Supported Codes by Participants

Appendix J – Summary of Concerns Not Supported Code Locations for All Participants

	Participant examples												
	Adam	Brian	Cassandra	Danielle	Emily	Faith	George	Heather	Julia	Kevin	Lisa	Mabel	Noah
Points of Interest													
Burden		15-94 (grading)								18-123 (grading)			11-68 (grading)
Negative social consequences			11-84, 11-87 **(phone number)										21-138 (with another UTA personal, unrelated)
Negative part of experience											15-92 (grading)	19-138, 22-157 (stress initially-lacked confidence) (student frustration)	
Explicitly states nothing negative	15-107	15-94			30-22	20-177 26-247	30-97	9-70, 11-88	36-74	15-93, 18-123, 19-129, 28-62	19-116 19-122	24-172	
Conflict of interest													
Regrets - none	24-47	23-40	21-4	35-63, 5-65	47-92	34-60	43-52, 43-55	21-75	36-74	30-67	29-68	31-45	35-37

Appendix J above shows the location of each individual code for Concerns Not Supported within the transcript of each participant. Information can be interpreted as page-box number. For example, on page 15 in box 94 of Adam's transcript, he provided an explanation of how he experienced a potential burden during his time as an UTA, in this case in the form of grading.

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